Spinicaudata Catalogus (Crustacea: Branchiopoda)

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Received 18 October 2019 / Accepted 14 January 2020 / Published 5 August 2020

Special issue (articles 32-46) communicated by Thomas A. Hegna and D. Christopher Rogers

The Spinicaudata (spiny clam shrimp) are a large group of freshwater, bivalved branchiopod crustaceans in need of taxonomic revision. Herein, the extant Spinicaudata families and genera are defined and diagnosed according to modern standards. An annotated catalogue of the Spinicaudata taxa is presented with synonyms. More than 747 spinicaudatan taxa are presented, of which 215 are considered valid families, genera and species. Chresonyms are provided for taxa redescribed according to modern standards. It is hoped that this catalogue will provide a basis for further taxonomic revision and phylogenetic work within the Spinicaudata.

Key words: Spiny clam shrimp, Diplostraca, Onychocauda, Checklist, Systematics.

BACKGROUND

The Spinicaudata (spiny clam shrimp) are the second largest group of freshwater dwelling bivalved branchiopod crustaceans after the Cladocera (Brendonck et al. 2008; Rogers 2009) and have the most confused taxonomy of any branchiopod group. This confusion resulted from a combination of: 1) the great plasticity of the few available morphological characters within the group; 2) the tremendous and poorly understood range of intra- and interspecific, generic and familial morphological variation; 3) the lack of sexually selected characters and high number of hermaphroditic lineages; 4) poor and inadequate descriptions and type material; 5) a great disparity between the methods and descriptive language used by clam shrimp palaeontologists and biologists, and; 6) the large number of researchers working in isolation and/or focusing only on local taxa when more holistic approaches were needed.

This catalogue is the third produced on the Branchiopoda, the first two being on the Anostraca (Rogers 2013) and the Laevicaudata (Rogers and Olesen 2014). This catalogue is patterned in part on the recent catalogs on decapod crustaceans (e.g., Ng et al. 2008, De Grave and Fransen 2011).

Spinicaudatan fossils have been reported from as far back as the Devonian (Tasch 1969) and from all continents, with extant forms known to occur on all continents except Antarctica as well as many oceanic islands (Brendonck et al. 2008, Rogers 2009). Modern clam shrimp occur in seasonally astatic aquatic habitats and inland saline pools and lakes (Brendonck et al. 2008; Rogers 2009). The number of spinicaudatan species has historically been in flux, as many species have myriad synonyms, many nomina inquirenda occur, and many new species are described regularly. Some 195 valid species names are recognized here. Endemicity is high, with 41.7% of species known only from the type locality and 27.1% known from ten or fewer localities.

This catalog also reflects the many advances in phylogeny made in recent years (e.g., Schwentner et al. 2009 2020a; Weeks et al. 2009), as well as classifications based upon modern genus concepts (e.g., Belk 1989; Rogers et al. 2012). There are 748 taxa presented in this checklist under the suborder Spinicaudata, including four valid families, 16 valid genera, 194 valid species, and 572 synonyms, homonyms, nomina nuda, nomina dubia, species inquirendae, and nomina oblita. Chresonyms
A Brief History of Spinicaudata Taxonomy

Although originally treated with the Laevicaudata and Cyclestherida in the order Conchostraca, morphological and, eventually, molecular studies demonstrated that this concept was invalid (Fryer 1987; Olesen 1998 2000 2007 2009; Negrea et al. 1999; Spears and Abele 2000; Brabrand et al. 2002; deWaard et al. 2006; Stenderup et al. 2006; Richter et al. 2007; Schwentner et al. 2018). The term ‘Conchostraca’ was abandoned as a useful concept in the early 1980s, and the name now conveys no systematic or phylogenetic meaning (Fryer 1987; Olesen 1998 2000; Martin and Davis 2001; Brendonck et al. 2008; Rogers 2009; Ahyong et al. 2011) and should not be used. Following modern methods, all extant clam shrimp groups and the Cladocera are placed within the order Diplostraca, which contains the Laevicaudata (smooth clam shrimp) and the Onchyocaudata (Schwentner et al. 2018). Onchyocaudata comprises the Spinicaudata and the Cladoceromorpha, with Cladoceromorpha comprising Cyclestherida and Cladocera (Olesen 2007 2009; Olesen and Richter 2013).

Linnaeus (1761) described the first spinicaudatan clam shrimp: Monoculus lenticularis. Hermann (1804) described a second species, which he called Daphnia gigas. Brongniart (1820) based on material from France, described Limnadia hermanni, giving us the first of the currently recognized genera. All three of these first taxa (and others) were eventually synonymized as Limnadia lenticularis (Linnaeus, 1761).

Audouin (1837) erected Cyzicus to contain Limnadia tetracerus Krynicky, 1830 and his Cyzicus bravaisii. Rüppell (in Strauss-Durheim 1837) erected Estheria for his species E. dahalacensis, with the genus characters given being identical to Audouin’s Cyzicus (Mattox, 1957a). However, Rüppell’s collection was comprised of both Cyzicus and what would eventually be called Leptestheria. Keillhack (1910) recognized that Estheria Rüppell was a homonym of Estheria Robineau-Desvoidy 1830 (Diptera) and thus preoccupied. Joly (1842) in his review of the clam shrimp proposed Isaura to replace Rüppell’s Estheria, rejecting the name Cyzicus. However, Daday (1915) pointed out that Cyzicus had priority and that the name Isaura was debatably preoccupied by Isaura Savingny, 1817 (Cnidaria). Daday (1913a b 1915) moved Estheria dahalacensis Rüppell, 1837 to a new genus: Leptestheria. Bock (1953) argued strongly for maintaining the genus name Isaura, creating a new family for it, ignoring the priority of Cyzicus. Mattox (1957a) officially put the matter to rest by presenting the entire history of the controversy before the IUCN, who put the name Cyzicus on the Official List of Generic Names, and put Estheria Rüppell, 1837 and Isaura Joly, 1842 on the Official List of Rejected and Invalid Names (ICZN 1958). Strangely, Alonso (1966) and Dumont and Negrea (2002) chose to use Isaura over Leptestheria with no explanation. (Some palaeontologists did as well; e.g., Reible 1962).

Joly (1842) provided a review of the few European taxa described. The first monographic treatment of Spinicaudata was prepared by Baird (1849), wherein all spinicaudatans were placed in the Limnadiidae. Baird (1849) provides a very interesting history of the discovery of spinicaudatans, describing the great confusion in the taxonomy already apparent in less than 100 years of the group’s taxonomy. Unfortunately, Baird (1849) added to the confusion, by redescribing taxa he had never actually observed and leaving type specimens that were nothing more than dry, empty carapaces. Some of his taxa have subsequently been treated as nomina nuda or inquirenda due to the lack of detail in his descriptions and the condition of some of his type material (Rogers and Padhye 2015).

The first real monographs were provided by Daday, wherein he described numerous new and redescribed old species from all over the world (Daday 1913a b 1914 1915 1923 1925 1926). Daday revised the spinicaudatan clam shrimp genera in three papers (Daday 1913a b 1915) creating a certain amount of confusion in the process. The first two were published in separate journals, but both on 12 April. In these two papers he presents new genera, of which Caenestheria and Eocyzicus were nomina nuda, until the descriptions and definitions were published by Daday in 1915. Daday describes Caenestheriella, Eoleptestheria, Leptestheria, and Leppestheriella (in that order) in his 1913a paper, and uses those names in his 1913b paper, but neither paper cites the other. Many of Daday’s taxa
and others were defined based on characters of the carapace (number of growth lines, carapace proportions, and ornamentation of the intervals), number of limbs, number of antennomeres, and spine arrangements.

Although Daday’s (1913a b 1914 1915 1923 1925 1926) monographs were greatly criticized (e.g., Ueno 1927; Barnard 1929; Brehm 1933; Gauthier 1933; Linder 1945; Botnariuc 1945 1947; Margalef 1953; Straškraba 1965a b 1966) no competing system was developed. Furthermore, although many authors (Vecchi 1922; Gauthier 1933; Linder 1945; Botnariuc 1945 1947; Straškraba 1965a b 1966; Wiltshire 1973; Marinček and Petrov 1985; Petrov and Marinček 1995; Rogers et al. 2012 2017) demonstrated that most traditional characters used to describe spinicaudatans were dependent on the age of the animal or on the nutritive quality of the food received, new taxa were still described using those characters (e.g., Mattox 1953a 1954a b; Nayar and Nair 1968; Hu 1988a), even though many of those authors cited these works and lauded their findings.

Brtek (1997 2002) provided the first modern catalogues of all branchiopod taxa, including Spinicaudata. Unfortunately, the text has many problems and has created confusion (criticised in Rogers 2003 2006). The English and editing is poor, and several taxa previously synonymized based on quantified analyses were resurrected without any justification, and little if any mention of the previous analyses. Similarly, two species are shown as valid names simultaneously in two separate genera (Cyzicus crinitus (Thiele, 1900) and C. ellipticus (Sars, 1897) also in Eocyzyicus).

Naganawa (2001a b) presented a new classification for the Spinicaudata, presenting all large branchiopod crustaceans (Anostroca, Notostraca, and clam shrimp) in a separate subclass from the Cladocera, and furthermore broke up the Spinicaudata into three suborders: Cyclostraca (containing the Cyclestheriidae (of the separate order Cyclestheridae)); Spinoirostra (containing the Cyzicids and Lep)testheriids, divided among five families), and; Procephalida (containing the Limnadiidae, divided among three families). However, none of the previous nor later morphological and molecular work supported Naganawa’s classification.

Since 1996, numerous morphological studies (Belk 1996; Martin and Belk 1989; Olesen 1998 2000 2007 2009; Rabet 2010; Orridge 2011; Rabet et al. 2015; Rogers et al. 2017; Schwentner et al. 2012a; Timms 2016a b 2018; Timms and Schwentner 2017; Tippelt and Schwentner 2018), molecular studies using increasingly more powerful analyses (Spears and Abele 2000; Brabrand et al. 2002; de Waard et al. 2006; Hoeh et al. 2006; Stenderup et al. 2006; Richter et al. 2007; Reiger et al. 2010; Sun et al. 2011; Fritsch et al. 2013; Schwentner et al. 2009 2012b 2018 2020a) and combined analyses (Weeks et al. 2009; Schwentner et al. 2011; Rogers et al. 2012; Richter et al. 2007) have resolved the relationships between the Diplostracan suborders, relationships between Spinicaudata families and genera, and informed species definitions. At this time, we have the clearest conceptual understanding of the higher taxonomy and phylogenetic relationships at family level and above that we have ever had. However, there is still much work to be done at genus and species levels.

**Catalogue structure**

The catalogue portion follows the format of the recent catalogues on branchiopod (Rogers 2013; Rogers and Olesen 2014) and decapod crustaceans (e.g., Ng et al. 2008; De Grave and Fransen 2011) for taxonomic consistency among these widely used tools. Supraspecific taxa are presented in bold. Genera and species are listed alphabetically. Synonyms are presented following an equal sign (=). Only taxonomically relevant references are included due to space. Where an important analysis is relevant for a synonymy, a reference is provided as “fide” the synonymizer. For example: = Eulimnadia chacoensis Gurney, 1931 fide Martin 1989. Chresonyms are presented parenthetically after the original author and date, and are referred to as “in the sense of” the redescriber. For example: Limnadopsis parvispinus Henry, 1924 sensu Timms, 2009a.

Comments are provided as appropriate, including distribution, important type localities, type material locations, and outlier localities. However, many of the determinations here are in need of verification: records are included, but not necessarily verified or substantiated. Historically, most workers only examined taxa from their region, with no comparative analysis against identified material from other areas. To this day, it is a problem despite all the literature that demonstrates that such a myopic view is nearly useless. The Spinicaudata are very plastic, taxonomically confused, and many are poorly described. All information presented here needs to be checked in detail, through additional collections, examination of specimens and if possible molecular studies as well. These errors may be due to my missing a certain piece of literature, or misunderstanding some datum. This catalogue is designed as a starting point for future revisionary work using modern methods and a broad, global perspective of these animals. That being said, I expect that there are errors in this catalogue.

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RESULTS

SYSTEMATICS

Spinicaudatan systematics have been problematic from the beginning. However, great strides have been made in the last two decades establishing the families and genera and their evolutionary relationships. One thing is salient: spinicaudatan taxonomic categories must be defined using molecular tools and morphological characters that are informed by good molecular data. At this time, some genera are reasonably well defined, but most need revision. These genera are being used here as categorical groups for species placement, pending proper testing of those genera. I am confident that more genus level clades and species will be revealed.

On the other hand, spinicaudatan species are mostly poorly defined, and we are just beginning to understand and appreciate the complexity of the group. The species listed here are nearly all problematic, in need of comparison with related forms, and need detailed molecular study in order to properly revise them. I expect that a great many of the species listed here are invalid. I equally suspect that there are a great many more undescribed species that we have yet to descry even in the material before us.

CLASS BRANCHIOPODA Latreille, 1817
SUBCLASS PHYLLOPODA Tasch, 1969
Diplostraca, Gerstaecker, 1866
Spinicaudata Linder, 1945
= Spinirostria Naganawa, 2001b New Combination
= Procephalida Naganawa, 2001b New Combination

Diagnosis: Branchiopod diplostracan crustaceans with carapace not truly bivalved, no hinge present. Carapace folded in half longitudinally, generally bearing growth lines. Entire adult animal encompassed within carapace. Antenna I is not subarticulated. Male first two limb pairs modified as claspers to amplex female during mating.

Comments: Naganawa (2001b) proposed a major phylogenetic split within Spinicaudata, with the Limnadiidae in the “Procephalida” and the remaining spinicaudatan families in the “Spinirostria”. Similarly, Astrop and Hegna (2015) produced a phylogeny hypothesising that the Limnadiidae are the living remnant of the Vertexioidea Kobayashi, 1954, sensu Astrop & Hegna, 2015, and that the remaining extant spinicaudatan families were the living remnant of the Eosestherioidea Zhang & Chen, in Zhang et al., 1976, sensu Chen & Shen, 1985. However, the molecular analyses of Schwentner et al. (2020a) does not support either of these hypotheses.

Limnadiidae Burmeister, 1843
= Limnadiidae Burmeister, 1843 nomen nullum fide Tasch 1969
= Limnadiidae Baird, 1849 nomen imperfectum
= Limnadiidae Girard, 1854 nomen imperfectum
= Limnadiidae Botnaric & Orghidan, 1941
= Estheriidae (Kobayashi, 1954)
= Limnadopsiidae Novojilov, 1958
= Limnadopsidea Novojilov, 1958
= Limnadopsidae Tasch, 1969
= Paralimnadiidae Roessler, 1991a
= Metalimnadiidae Roessler, 1995a
= Limnadopsinae Dumont & Negrea, 2002

Diagnosis: (modified from Rogers et al. 2012) Cephalic fornicies absent. Rostrum variable, blunt to acute, long or short. Rostrum lacking an apical spine. Compound eyes projecting in ocular tubercle. Frontal organ present, typically pedunculate, sometimes sessile (Metalimnadia and Inmadia). Occipital condyle present or absent. Carapace thin, laterally compressed, umbone present (Limnadopsis), lacking (most genera) or obscure (Metalimnadia). Carapace with or without melanistic pigmentation, growth lines often obscured or absent. Male first two thoracopods with endopod (sensu Olesen 2007) bearing apical suctorial organ or modified tactile setae (absent in Metalimnadia). Eggs 170–250 μm in diameter, varying in shape and ornamentation.

Comments: Rogers et al. (2012) conducted a preliminary revision of the limnadiid genera, primarily to create well defined categories for species group revisions. This starting point has allowed for quantitative species revisions, and provided a quantitative basis for describing new taxa (Timms and Schwentner 2012 2017).

The eggs are highly ornamented in this family, and the egg morphology is typically species specific. Important works for this family include Belk (1989), Pereira and García (2001), Rogers et al. (2012), and Bellec and Rabet (2016). Bellec and Rabet (2016) report an undescribed genus under the name “Limnadiidae lineage BO sp. 1”, which has been supported in molecular studies (Schwentner et al. 2020a).

Australimnadia Timms & Schwentner, 2012

Diagnosis: (modified from Timms and Schwentner 2012 2017). Populations composed of males and hermaphrodites; amplexus has not been observed. Rostrum broadly triangular, with female rostrum more apically rounded. Angle between rostrum and frons from 90° to 100°. Occipital notch, occipital condyle absents.
Frontal organ pedunculate, length 0.3–2.5x distance of organ from ocular tubercle. Carapace dorsal margin smooth, lacking carinae, hinge line arcuate. Umbone absent. Carapace unpigmented. Muscle scar circular, or angled 35° to 45° from normal, i.e., body horizontal axis. Clasper endopods bearing an apical suctorial organ. Endite IV with apical dense field of long spines. Female IX and X thoracopods with elongated exopod for egg attachment. Thoracic segments with a low medial protrusion or spines. Telsonic ventroposterior angle without spiniform projection. Telson spine rows each with 20–25 spines. Telsonic spine rows heteromorphic between portions anterior and posterior of the caudal filaments. Caudal filaments inserted between the eighth and tenth spine pair, on a low or prominent mound. Cercopods sinuate to straight, with a proximal dorsomedial longitudinal row of plumose setae extending 50–80% of the cercopod, and a dorsal cirrus on the apical 10–20% of the cercopod.

Eggs double discoid or nearly double discoid with broad facets.

Comments: The type species is *Australimnadia gigantea* Timms & Schwentner, 2012, a junior synonym of *Limnadia grobbeni* Daday, 1925: 160, by original designation. The eggs of all three species are depicted in Timms and Schwentner (2017).

**Attributed Species**

*Australimnadia gigantea* (Daday, 1926)

= *Limnadia grobbeni* Daday, 1926

= *Australimnadia gigantea* Timms & Schwentner, 2012 (fide Timms and Schwentner 2017)

Comments: Eastern and northern Australia.

*Australimnadia multifaciata* Timms & Schwentner, 2017

Comments: Australia: Western Australia, along the Pilbara Coast.

*Australimnadia torqueova* Timms & Schwentner, 2017

Comments: Southwestern coast of Western Australia.

**Calalimnadia Rabet & Rogers, in Rogers et al., 2012**

Diagnosis: (modified from Rogers et al. 2012) Populations composed of males and hermaphrodites (except *E. agassizii* which is only composed of hermaphrodites); amplexus is venter to venter. Rostrum variable, blunt to acuate, long or short. Angle between rostrum and frons 80° to 100°. Occipital notch occipital condyle absent. Pedunculate frontal organ length approximately 1.5x distance of organ from ocular tubercle. Carapace dorsal margin smooth, lacking carinae, hinge line arcuate, rarely sinuate. Carapace surface between growth lines smooth. Umbone absent.

**Eulimnadia Packard, 1874**

= *Eulimadia* (in error). Sars, 1895, 1896a b

= *Limnadia* Webb & Bell, 1979; Brtek 1997; Naganawa 2001a b

= *Uenia* Naganawa, 2001b

Comments: Known only from Mauritius Island.
Carapace occasionally pigmented. Muscle scar angle from 0° to 90° from normal. Clasper endopods each bearing an apical suctorial organ. Endite IV may be broadly transverse or bear dense apical field of short setae, or a few long setae or spines. Thoracic segments smooth or with dorsoposterior ridge rimmed with spines or setae. Eggs attaching to prolonged exopods of thoracopods VII and VIII or VIII to IX or XII, IX and X, X and XI, or XI and XII. Telson with a subcercopodal, posteriorly directed spiniform projection on ventroposterior angle, anteriad of cercopod base. Telson posterior margin posteriolateral spine rows confluent dorsally, with confluence not projecting. Each row has from 6 to 22 spines. Caudal filament originating between spine rows at second, third, fourth, fifth, or seventh spines from confluence. Caudal filament borne on projecting mound. Cercopods arcuate, occasionally sinuate. Cercopod with medial longitudinal setal row on proximal 75 to 80%. Setae plumose and long. Setal row terminates with single spine. Cercopod with subapical, dorsal cirrus, extending from 5–30% of cercopod length. Eggs 170–250 μm in diameter. Shape spherical to subspherical or cylindrical to subcylindrical with one end larger than other. Eggs with large rectilinear polygonal depressions separated by ridges, occasionally with lamellar or setaform spines at polygon ridge line confluences (Belk 1989; Martin 1989; Martin and Belk 1989; Rabet 2010).

Comments: No type species was designated by Packard (1874). The type for the genus is designated here as Limnadia agassizii. Important works on this genus include Belk (1989), Martin (1989), Martin and Belk (1989), Rabet (2010), Rogers et al. (2012), and Marinone et al. (2016). Species are so far only reliably separated by egg morphology (Belk 1989; Martin and Belk 1989; Rabet 2010; Rogers et al. 2012; Padhye and Kulkarni 2017), including internal characters (Rabet et al. 2015). However, external characters in sediment collected eggs may be affected by the environment (Rabet et al. 2014).

Eulimnadia acutirostris Daday, 1926 sensu Rabet, 2010; Rabet et al., 2015 = Limnadia acutirostris (Daday, 1926)

Comments: Known only from the type locality in either Niger or Mali, in the Niger River Basin. Redescribed by Rabet et al. (2015).

Eulimnadia adarensis Rabet & Lluch, in Rabet et al., 2015

Comments: From two pools in the Wagchoodda Region of Mauritania.

Eulimnadia aethiopica Daday, 1926 sensu Rabet, 2010; Rabet et al., 2015 = Limnadia aethiopica (Daday, 1926)

Comments: The type locality is either modern day Chad or Cameroon, and is the only known locality for this species. Figured by Monod (1969a) and redescribed according to modern standards by Rabet et al. (2015).

Eulimnadia agassizii (Packard, 1874) = Limnadia agassizii Packard, 1874 = Eulimnadia stoningtonensis Berry, 1926, fide Belk, 1989

Comments: USA: New England states. The type locality is Penikese Island, Massachusetts. The egg is depicted in Belk (1989). Smith (1992) redescribed the type material and provided SEM images of the egg.

Eulimnadia antlei Mackin, 1940 = Limnadia antlei (Mackin, 1940)

Comments: USA. The egg is figured in Belk (1989).


Comments: USA. The egg is figured in the original description.

Eulimnadia australiensis Timms, 2016a = Eulimnadia australicemsis Timms, 2016a
Eulimnadia behningi Smirnov, 1949
= Limnadia behningi (Smirnov, 1949)

Comments: Uzbekistan. The egg is unknown.

Eulimnadia belki Martin, 1989
= Limnadia belki (Martin, 1989)

Comments: ranges from southern México south to northern South America (Rogers and Cruz-Rivera 2020). Brendonck et al. (1990) demonstrates great overlap in the egg morphology among New World taxa with cylindrical eggs.

Eulimnadia beverleyae Timms, 2016a

Comments: Paroo Desert of New South Wales and Queensland, Australia.

Eulimnadia bondi Padhye, Rabet, Kulkarni and Pagni, 2018

Comments: Goa State, India. The eggs are cylindrical. This species should be compared with E. indocylindrova, E. taoluoensis, and E. braueriana.

Eulimnadia brasiliensis Sars, 1902
= Limnadia brasiliensis (Sars, 1902)


Eulimnadia braueriana Ishikawa, 1895
= Limnadia braueriana (Ishikawa, 1895)
= Eulimnadia packardiana Ishikawa, 1895 (fide Rabet 2010)
= Limnadia packardiana (Ishikawa, 1895) (fide Rabet 2010)
= Eulimnadia taoluoensis Hu, 1986a
= Limnadia taoluoensis (Hu, 1986a)

Comments: Eastern China, Japan, Korea, Taiwan (Hu 1986; Olesen and Grygier 2003; Shen and Huang 2008; Kwon et al. 2010; Rabet 2010; Wang 2014). The type locality for E. braueriana is Kugenuma in modern Kanagawa Province, Japan, and the type locality for E. packardiana is Nikkō in Tochigi Province, Japan. Hu described E. taoluoensis in his 1986a paper, but also presented it as new in his 1986b paper. Naganawa and Orgilijanova (2000) treated E. taoluoensis as a junior synonym of E. braueriana, but provided no explanation. Comparison of the eggs for the two taxa (Shen and Huang 2008: 354, fig. 1D and; Wang et al. 2014: 414, fig. 2B) demonstrate that they are probably synonyms. However, Shen and Huang’s (2008) SEM of the egg from the vicinity (?) of the type locality, depicts eggs that are covered in debris, and were possibly air dried alcoholic specimens (Rogers and Padhye 2015). They appear to be lacking “inflated rims” (Rabet 2010), but this could be an artefact of maturity or preservation and drying. This species needs to be compared with E. indocylindrova and E. bondi.

Eulimnadia canalis Timms, 2016a

Comments: Australia: northwestern New South Wales and southwestern Queensland.

Eulimnadia chacoensis Gurney, 1931
= Limnadia chacoensis (Gurney, 1931)


Eulimnadia chaperi (Simon, 1886) (fide Padhye & Rabet 2017)
= Limnadia chaperi Simon, 1886
= Eulimnadia azisi Subash Babu & Bijoy Nandan, 2010 (fide Padhye and Rabet 2017)

Comments: Type locality given is India: Karnataka State: Ballari. Treated as a junior synonym of E. compressa by Daday (1927). Redescribed by Padhye and Rabet (2017). The egg is remarkably similar to E. cryptus, and SEM is required for separation.

Eulimnadia colombiensis Sars, 1902
= Limnadia colombiensis Sars, 1902
= Eulimnadia “columbica” Daday unpublished ms name (fide Martin 1989)
= Eulimnadia belki Martin, 1989
= Limnadia belki (Martin, 1989)

Comments: northern South America (Rogers...
Brendonck et al. (1990) demonstrates great overlap in the egg morphology among New World taxa with cylindrical eggs. The egg is depicted in Roessler (1989, 1991b) and in Pereira and García (2001).

**Eulimnadia contraria** Timms, 2016a

= *Eulimnadia* sp. E Schwentner et al., 2015 (fide Timms 2016a)

Comments: Central Queensland, Australia.

**Eulimnadia cryptus** Sanoamang, Padhye, and Rogers, 2020

= *Eulimnadia* “magdalensis” Rabet, 2010
= *Eulimnadia* “magdalensis” Padhye & Rabet 2017

Comments: India, Thailand, and Cambodia. The eggs are remarkably similar to *E. magdalensis* of the Americas, and *E. chaperi*. SEM is required for proper identification.

**Eulimnadia cylindrova** Belk, 1989

= *Limnadia cylindrova* (Belk, 1989)

Comments: From deserts of southern USA and northern México (Rogers and Cruz-Rivera 2020). Brendonck et al. (1990) demonstrates great overlap in the egg morphology among New World taxa with cylindrical eggs. The egg is depicted in the original description and in Pereira and García (2001).

**Eulimnadia dahlia** Sars, 1896b (fide Timms 2016a)

= *Limnadia dahlia* (Sars, 1896b)

Comments: Northern Territory, Queensland, and Western Australia, Australia. The egg is figured by Timms (2016a).

**Eulimnadia diversa** Mattox, 1937

= *Limnadia diversa* (Mattox, 1937), fide Belk, 1989
= *Eulimnadia inflecta* Mattox, 1939, fide Belk, 1989
= *Eulimnadia thompsoni* Mattox, 1939, fide Belk, 1989
= *Eulimnadia alineata* Mattox, 1953a, fide Belk, 1989
= *Eulimnadia ventricosa* Mattox, 1953b, fide Belk, 1989
= *Eulimnadia oryzae* Mattox, 1954a, fide Belk, 1989

Comments: USA east of the Great Plains, with invasive populations in California. The egg is figured in Belk (1989).

**Eulimnadia dubia** Daday, 1913a

= *Limnadia dubia* (Daday, 1913a)

Comments: New Guinea. The egg is undescribed.

**Eulimnadia follisimilis** (Pereira & García, 2001)

Comments: Venezuela.

**Eulimnadia garretti** (Richters, 1882)

= *Limnadia garretti* Richters, 1882

Comments: Tahiti. The egg has not been figured, but this species is being redescribed.

**Eulimnadia geayi** Daday, 1913a

= *Limnadia geayi* (Daday, 1913a)
= *Eulimnadia* “columbica” Daday unpublished ms name (fide Martin 1989)

Comments: Mexico to Colombia and Venezuela (Pereira and García 2001; Reed et al. 2015). The egg is depicted by Martin (1989) and Pereira and García (2001). Martin (1989) points out that: “Daday’s (1926) illustration of the egg of *E. geayi* also shows a spherical egg with somewhat acute surface projections, but this is inconsistent with eggs of *E. geayi* in the Hungarian Museum. The eggs of *E. geayi* are short, grooved cylinders with one end of the cylinder slightly wider than the other.”

**Eulimnadia gibba** Sars, 1900

= *Limnadia gibba* (Sars, 1900)

Comments: Tamil Nadu, India. Rogers and Padhye (2015) discuss *E. gibba* and suggest that it needs closer examination.

**Eulimnadia gnammophila** Timms, 2016a

= *Eulimnadia dahli* in Timms, 2006, Weeks et al., 2006, and Reed et al., 2015 (fide Timms 2016)
= *Eulimnadia feriensis* in Weeks et al., 2006, and in Reed et al., 2015 (fide Timms 2016a)

Comments: Occurs across the southern portions of Australia from Western Australia to Victoria. This species is a gnamma (rockpool) specialist.
**Eulimnadia graniticola** Rogers, Weeks, & Hoeh, 2010

*Comments*: Georgia and Florida, USA.

**Eulimnadia hansonii** Timms, 2016a

= *Eulimnadia* sp. G Schwentner et al., 2015 (fide Timms 2016a)

= *Eulimnadia* sp. H Schwentner et al., 2015 (fide Timms 2016a)

= *Eulimnadia* sp. K Schwentner et al., 2015 (fide Timms 2016a)

= *Eulimnadia* sp. O Schwentner et al., 2015 (fide Timms 2016a)

*Comments*: Inland Australia, particularly in the Paroo Desert region.

**Eulimnadia indocylindrova** Durga Prasad & Simhachalam, 2004 (fide Padhye et al. 2015)

*Comments*: India, Thailand (Rogers et al. 2016a). Rogers et al. (2016a) suggest that *E. indocylindrova* may be a synonym of *E. taoluoensis*. Images of the egg in Shen and Huang (2008: 354, fig. 1C) are of specimens obscured by debris and were possibly air dried alcoholic specimens before being prepared for SEM study. They appear to be lacking “inflated rims” (Rabet 2010), but this could be an artefact of egg shell maturity or air drying (Rogers et al. 2016a). This species needs to be compared closely with *E. braueriana* and *E. bondi*. It is possible that *E. braueriana* is a senior synonym of *E. indocylindrova*.

**Eulimnadia insularis** Rogers & Cruz-Rivera, 2020

= *Eulimnadia texana* (Packard, 1871) in Smith and Wier 1999


**Eulimnadia kimberleyensis** Timms, 2018

*Comments*: Australia: Western Australia, known only from the Gardner Plateau. This species is a rock pool (gnamma) specialist.

**Eulimnadia magdalenis** Roessler, 1990 sensu Rabet, 2010

*Comments*: Brazil, Colombia, Venezuela (Roessler 1995a; Pereira and Garcia 2001; Rogers et al. 2012 2014; Godinho et al. 2014; Bellec and Rabet 2016; Marinone et al. 2016; Rogers et al. 2020). Material reported from Cambodia (Rabet 2010; Padhye and Rabet 2017) needs further examination but is probably conspecific with *E. cryptus*. The egg is pictured in Pereira and Garcia (2001) and Marinone et al. (2016).

**Eulimnadia margaretae** Bond, 1934 sensu Thiéry, 1996, Rabet et al., 2015

= *Limnadia margaretae* (Bond, 1934)

*Comments*: Oman, United Arab Emirates, Yeemen (Rabet et al. 2015). Redescribed by Rabet et al. (2015).

**Eulimnadia mauritiana** (Guérin, 1837)

= *Limnadia mauritiana* (Guérin, 1837)

*Comments*: Mauritius (Simon 1886).

**Eulimnadia michaeli** Nayar & Nair, 1968 sensu Rogers, Dadseepai, & Sanoamuang, 2016a

= *Limnadia michaeli* (Nayar & Nair, 1968)

= *Eulimnadia khoratensis* Rogers, Dadseepai, & Sanoamuang, 2016a

*Comments*: India, Sri Lanka, Thailand (Rogers and Padhye 2015; Rogers et al. 2016a; Padhye and Kulkarni 2017). The types are presumed lost. The eggs are figured in Samyiah et al. (1985), Rogers et al. (2016a), and also in Padhye and Kulkarni (2017), who examine morphological variation in this species.

**Eulimnadia orinoquiensis** (Roessler, 1991b) fide Rogers et al. 2020

= *Limnadia orinoquiensis* Roessler, 1991b

*Comments*: Colombia.

**Eulimnadia ovilunata** Martin & Belk, 1989

= *Eulimnadia* sp. A. Martin, 1989

*Comments*: Argentina, Brazil (Martin and Belk 1989; Marinone et al. 2016). The egg is pictured in Marinone et al. (2016) and in the original description.

**Eulimnadia ovisimilis** Martin & Belk, 1989

= *Eulimnadia ovisimilis* (Belk, 1989) in error in Durga Prasad & Simhachalam, 2004
Comments: Paraguay and Argentina. Brendonck et al. (1990) demonstrates great overlap in the egg morphology among New World taxa with cylindrical eggs. The egg for *E. ovisimilis* is presented in the original description and Marinone et al. (2016). Marinone et al. (2016) demonstrate that this species may very well be a junior synonym of *E. chacoensis*.

**Eulimnadia pampa** Marinone, Urcola & Rabet, 2016  
= *Limnadia brasiliensis* (Sars, 1902) in César, 1990  
Comments: Argentina.

**Eulimnadia pinocchionis** Timms, 2016a  
Comments: Known only from the type locality a single gnamma (rock pool) in the Pilbara coastal plain of Western Australia.

**Eulimnadia rogersi** Rabet & Gallerne, in Rabet et al., 2015  
Comments: Known only from the type locality in Adrar, Mauritania.

**Eulimnadia taroomaensis** Timms, 2016a  
= *Eulimnadia* sp. M Schwentner et al., 2015 (fide Timms 2016)  
Comments: Taroom District, Queensland, Australia.

**Eulimnadia texana** Packard, 1871  
= *Limnadia texana* (Packard, 1871)  

**Eulimnadia ulurensis** Timms, 2016a  
Comments: This species is a gnamma (rock pool) specialist, known only from Uluru and Kata Tjuta rocks, Northern Territory, Australia.

Nomina dubia, nuda, and species inquirendae:  

**Eulimnadia africana** (Brauer, 1877) nomen nudum fide Rabet et al. 2015  
= *Limnadia africana* Brauer, 1877  
Comments: Type locality given as “Khartoum”, in the Sudan. The eggs are unknown. Barnard’s (1929) material is probably a misidentification (Rabet et al. 2015).

**Eulimnadia antillarum** (Baird, 1852) nomen dubium fide Martin 1989, Rogers et al. 2020  
= *Limnadia antillarum* Baird, 1852  
Comments: Caribbean Islands and coasts. Full discussion of the confusion and history of this name in Rogers et al. (2020). The eggs are unknown.

**Eulimnadia azerbaidshanica** Smirnov, 1936 nomen dubium fide Rabet et al. 2015  
= *Limnadia azerbaidshanica* (Smirnov, 1936)  
Comments: The eggs are unknown.

**Eulimnadia compressa** (Baird, 1860) nomen dubium fide Padhye & Rabet 2017  
= *Estheria compressa* Baird, 1860  
= *Limnadia compressa* (Baird, 1860)  
= *Eulimnadia similis* Sars, 1900 fide Rabet 2010  
= *Limnadia similis* (Sars, 1900) fide Rabet 2010  
= *Eulimnadia* sp. Rogers et al., 2013  
Comments: India. Baird’s description was limited to the carapace and the types have been lost, while Dayad’s material is either unassignable or misidentified (Padhye and Rabet 2017).

**Eulimnadia curvirostris** Roen, 1952 species inquirenda  
= *Limnadia curvirostris* (Roen, 1952)  
Comments: Vicinity of Beidaihe, Hebei Province, China. No types were deposited or designated. The eggs are unknown, and it has not been collected since it was discovered. It is probably a synonym of *E. braueriana*.

**Eulimnadia gunturensis** Radhakrishna & Durga Prasad, 1976 species inquirenda  
= *Limnadia gunturensis* (Radhakrishna & Durga Prasad, 1976)  
Comments: Andhra Pradesh, India. The egg is unknown.

**Eulimnadia minuta** Dayad, 1926 nomen nudum (fide Rabet et al., 2015)  
= *Limnadia minuta* (Dayad, 1926)  
Comments: Described from the Ivindo area of
Gabon. The eggs are unknown.

*Eulimnadia kobai* Uéno, 1940 *species inquirenda*

= *Limnadia kobai* (Uéno, 1940)

**Comments:** Shenyang, Liaoning Province, China. No types were designated and no deposited material was referenced, and the egg was neither figured nor described. This species may be a synonym of *E. braueriana*. It is partially figured in Dong et al. (1982).

*Eulimnadia ovata* Nayar, 1965 *nomen dubium*

= *Limnadia ovata* (Nayar, 1965)

= *Eulimnadia ovata inversa* Battish, 1981

= *Limnadia ovata inversa* (Battish, 1981)

**Comments:** Northern India. The type locality is a ditch at Khetri, Rajasthan, near the Haryana border. The type locality for *E. o. inversa* is Ludhiana, in Punjab to the north. The eggs of this species are undescribed and the types are apparently lost (Rogers and Padhye 2015).

*Eulimnadia pulchra* Mohammad, 1986 *species inquirenda*

= *Limnadia pulchra* (Mohammad, 1986)

**Comments:** Iraq; known only from the type locality northeast of Baghdad, and a site near Mosul. The egg was never described. The type is a single male deposited in the British Museum (1984.191). Six paratypes were also collected, but their whereabouts were not recorded. Brtek (1997) writing about *E. pulchra*, inexplicably stated: “(the pertinence to this genus is uncertain) (sic) - probably gen. nov.” There is no obvious evidence as to what his statement was based upon.

*Eulimnadia santiaguensis* (Cesar, 1991) *species inquirenda* (fide Marinone et al., 2016)

= *Limnadia santiaguensis* Cesar, 1991

**Comments:** Argentina. Possibly a senior synonym of *E. pampa* (Marinone et al., 2016).

*Eulimnadia subtropica* Daday, 1913b *species inquirenda* (fide Rabet, 2010)

= *Limnadia subtropica* (Daday, 1913b)

**Comments:** The eggs are unknown.

*Eulimnadia tropica* Rammner, 1933 *nomina dubia* fide Rogers et al. 2020

= *Limnadia tropica* (Rammner, 1933)

**Comments:** The types are juveniles.

*Gondwanalimnadia* Rogers, Rabet and Weeks, 2016b

= *Afrolimnadia* Rogers, Rabet and Weeks, 2012

**Diagnosis:** (modified from Rogers et al. 2012) Populations composed of males and hermaphrodites; amplexus is venter to venter. Rostrum variable, typically rounded in females, acute to aciculate in males. Angle between rostrum and frons from 80° to 100°. Occipital notch occipital condyle absents. Pedunculate frontal organ length 0.7 to 2.5x distance of organ from ocular tubercle. Carapace dorsal margin smooth, lacking carinae, hinge line arcuate, rarely sinuate. Carapace surface between growth lines slightly to strongly malleate. Umbone absent. Carapace unpigmented. Muscle scar angle 35° to 40° from normal, i.e., body horizontal axis. Clasper endopods bearing an apical sectorial organ. Endite IV with an apical dense field of long spines. Female thoracopods IX and X with prolonged exopods for egg attachment. Thoracic segments smooth. Telson with posteriorly directed spiniform projection present at ventroposterior angle, anteriad of cercopod base. Telson posteriolateral spine rows confluent dorsally, confluence not projecting. Each row with 10–15 spines. Caudal filament originating between spine rows at third spine pair from confluence. Caudal filament never borne on mound. Cercopods dorsal margin sinuate, longer than ventral telson margin. Cercopod medial surface with single basal spine and longitudinal row of plumose setae along proximal 80%. Cercopod with subapical, dorsal cirri, extending 5% of the cercopod length. Males amplex females venter to venter, at right angles to female’s body. Egg diameter 100–150 μm, spherical to subspherical. Eggs with narrow, slit shaped depressions, separated by narrow ridges.

**Comments:** Rogers et al. (2012) described this genus based on material ascribed to *Eulimnadia alluaudi*. The name *Afrolimnadia*, however, was preoccupied for a fossil genus of spinicaudatan clam shrimp (Lioestheriidae) (Tasch 1987), and the same authors amended the name to *Gondwanalimnadia* (Rogers et al. 2016b). The authors were not fully confident in the specific determination for the material ascribed to this genus (see below). Therefore, whereas the genus is valid (based upon morphological (Rogers et al. 2012) and molecular (Weeks et al. 2009) studies) the identity of the sole species placed in this genus remains unclear. The egg is depicted by Rabet (2010).
Attributed Species

**Gondwanalimnadia alluaudi** (Daday, 1926)
- *Eulimnadia alluaudi* Daday, 1926
- *Limnadia alluaudi* (Daday, 1926)
- *Afrolimnadia alluaudi* (Daday, 1926)

*Comments*: The material examined by Rogers et al. (2012) was collected from the Republic of South Africa, identified based on the original description and other references to the South African fauna (Brendonck 1999). However, this species was originally described from Madagascar. There are obvious inconsistencies in the egg morphology (Rabet 2010) between the populations.

**Imnadia Hertzog, 1935**


Eggs 100-150 μm in diameter, subspherical with slit shaped polygonal depressions separated by lamellar ridges (Thiéry and Gasc 1991).

*Comments*: Monotypic.

**Imnadia yeyetta** Hertzog, 1935

= *Imnadia voitestii* Botnariuc and Orghidan, 1941
= *Imnadia cristata* Marinček, 1972
= *Imnadia banatica* Marinček & Valvajter, 1982
= *Imnadia panonica* Marinček et Petrov, 1984


**Limnadia Brongniart, 1820**

= *Monoculus Linnaeus, 1761*
= *Daphnia Herman, 1802*
= *Limnadella* Girard, 1854
= *Estheria* Baird, 1860


*Comments*: Bellec et al. (2018) presents the most recent review of the genus, but it is still limited. Additional revisionary work is needed, and the eggs need to be compared and studied in detail. There is still one additional undescribed species in the USA (Rogers per. obs.). Sars (1903) reported and figured *Limnadia* sp. which he reared from soil collected in Sumatra, identifying the form as *L. lenticularis*. Whether this represents a new species or contamination from one of his...
European cultures of *L. lenticularis* remains to be seen.

**Attributed Species**

*Limnadia americana* Morse, 1868

= *Limnadia lenticularis* (Linnaeus, 1761) pro partim

*Comments:* Southeastern USA. Bellec et al. (2018) demonstrates that this species is valid. The egg is depicted by Martin (1989).

*Limnadia lenticularis* (Linnaeus, 1761)

= *Monoculus lenticularis* Linnaeus, 1761

= *Daphnia gigas* Hermann, 1802

= *Estheria gigas* (Hermann, 1804)

= *Limnadia hermanni* Brogniart, 1820

= *Limnadia gigas* Grube, 1853

= *Limnadia americana* Morse, 1868


*Limnadia nipponica* Ishikawa, 1895

= *Limnadia lenticularis* (Linnaeus, 1761) pro partim


**Nomina nuda and species inquirendae**

*Limnadia coriacea* Haldeman, 1842 *species inquirenda*

= *Limnadella coriacea* (Haldeman, 1842)

= *Limnadella kitei* Girard, 1854 (fide Brtek, 1997)

= *Limnadia kitei* (Girard, 1854)

*Comments:* Unrecognisable from the description, reported once from Pennsylvania and once from Ohio, USA.

*Limnadia melotensis* Gulia, 1873 *nomen nudum*

= *Limnodia melitensis* Gulia, 1873 *nomen imperfectum*

*Comments:* Gulia (1873) mentions this taxon, but provides no description or figures, and no material was ever deposited.

*Limnadopsis* Spencer and Hall, 1896

= *Estheria* Baird, 1860 (in part)

= *Limnadiopsis nomen imperfectum* fide Daday, 1925; Schneider and Sissom 1982

= *Limnadiopsis* Novojilov, 1958

*Diagnosis:* (modified from Rogers et al. 2012) Populations composed of males and females; male amplexes female on posterior carapace margin, keeping body in line, single file, behind female. Rostrum variable, blunt to acute, triangular or truncated, long or short, lacking apical spine. Angle between rostrum and frons 50° to 100°. Occipital notch and condyle absent. Frontal organ pedunculate. Frontal organ length 1.0 to 3.5 times distance between base of frontal organ and base of ocular tubercle. Carapace dorsal margin growth lines expanded dorsally into carinae or smooth. Carapace hinge line arcuate or straight. Carapace surface between growth lines smooth. Umbone typically present, rarely absent. Carapace with or without some pigmentation. Muscle scar angle ranges from 40 to 90 degrees from normal. Thoracic segments may have a dorsoposterior ridge or a dorsoposterior projection margined with spines or setae. Male first two thoracopods with endopod with scaliform setae, lacking a suctoriel organ. Endite IV typical for family. Eggs attaching to prolonged exopods of thoracopods IV to XII, VI to XI, or IX, X and XI. Telson with or without a spiniform projection on ventroposterior angle anteriad of cercopod base. Telson posterior margin spine rows confluent dorsally, with confluence projecting dorsoposteriorly or with spines at confluence larger in diameter than subsequent spines. Each row averaging 22.3 spines. Caudal filament originating between spine rows at either third or fourth, or fourteenth and fifteenth spines from confluence. Cercopods arcuate, each medially with longitudinal setal row along proximal 30 to 70%. Setae plumose, simple or setaform spines, long or short. Setal row terminates in one to six spines. Cercopod with subapical, dorsal cirrus, extending 5 to 40% cercopod length. Eggs 150–200 μm in diameter, varying greatly in shape, with species specific morphology. Eggs with large polygonal depressions separated by ridges, occasionally with lamellar or setaform spines at polygon ridge line confluences (Timms 2009a).

*Comments:* Important works on this genus include Timms (2009a), Weeks et al. (2009), and Schwentner et al. (2011). As in most limnadiid genera, the egg morphology is also species specific. The eggs are depicted in Timms (2009a) and Schwentner et al. (2012a b).
Attributed Species

**Limnadopsis birchii** (Baird, 1860) *sensu* Timms, 2009a

= *Estheria birchii* Baird, 1860
= *Estheria birchi* Baird, 1860 *nomen imperfectum*
= *Limnadopsis squirei* Specner & Hall, 1896
= *Limnadiopsis britchii* *nomen imperfectum* Daday, 1925; Novojilov, 1958

*Comments*: Arid and semiarid inland Australia; not reported from Tasmania or Victoria. Baird’s types are missing, but Spencer and Hall’s types for *L. squirei* are available (Timms 2009a). The eggs are figured in Timms (2009a).

**Limnadopsis bloodwoodensis** Schwentner, Timms, and Richter, 2012a

= *Limnadopsis* sp. ‘Roskos’ Schwentner et al., 2011

*Comments*: Australia: New South Wales, Queensland.

**Limnadopsis brevirostris** Schwentner, Timms, and Richter, 2012a

= *Limnadopsis* sp. ‘Lagoon’ Schwentner et al., 2011

*Comments*: Known only from the type locality, Queensland, Australia.

**Limnadopsis centralensis** Schwentner, Timms, and Richter, 2012a

*Comments*: Erldunda-Curtin Springs area south of Alice Springs, Northern Territory, Australia.

**Limnadopsis minuta** Timms, 2009a

*Comments*: Known only from the type locality at Keep River National Park, Northern Territory, Australia. A surprisingly small species in this genus.

**Limnadopsis multilineata** Timms, 2009a

*Comments*: Australia: northern Western Australia.

**Limnadopsis occidentalis** Timms, 2009a

*Comments*: Australia: central Western Australia.

**Limnadopsis paradoxa** Timms, 2009a

*Comments*: Australia: New South Wales, South Australia (one record in each), Western Australia (many records).

**Limnadopsis paratatei** Schwentner, Timms, and Richter, 2012a

= *Limnadopsis* cf. *tatei* ‘Carter’s’ Schwentner et al., 2011

*Comments*: Paroo Desert on the New South Wales, Queensland border, Australia.

**Limnadopsis parvispinus** Henry, 1924 *sensu* Timms, 2009


**Limnadopsis pilbarensis** Timms, 2009a

*Comments*: Australia: Pilbarra region, in Western Australia.

**Limnadopsis tatei** Spencer and Hall, 1896 *sensu* Schwentner et al. 2012

= *Limnadia tatei* (Spencer and Hall, 1896)
= *Limnadopsis tatei* (Spencer and Hall, 1896)
= *Limnadopsis* cf. *tatei* ‘Titanic’ Schwentner et al., 2011

*Comments*: Central and northern inland Australia. The eggs are figured and a neotype fixed in Timms (2009a).

Nomina dubia

**Limnadopsis brunneus** Spencer and Hall, 1896 *nomen dubium*, fide Timms, 2009a

*Comments*: Described from four dried specimens (lost), collected in the vicinity of Darwin, Northern Territory. The description is not useful as the text and the figures are contradictory, and the characters used are not specific to any one *Limnadopsis* species (Timms 2009a). Material reported by Schnieder and Sissom (1982) cannot be located (Timms 2009a).

**Metalimnadia** Mattox, 1952

= *Paraimnadia* Roessler, 1991a

*Diagnosis*: (modified from Rogers et al. 2012) Populations composed of males and females; amplexus is venter to venter. Rostrum acute, truncated or elongate and truncated in both sexes. Angle between rostrum and frons 80° to 110°. Occipital notch present. Frontal organ sessile, slightly protruding. Carapace dorsal margin...
smooth, without dorsal carinae. Umbone present, with lateral carinae or tubercles. Hinge line straight or arcuate, anterior end may project. Carapace surface between growth lines smooth, punctate, or malleate. Carapace often with pigmentation. Muscle scar circular or elongate, with angle at 20 degrees from normal. Thoracic segments sometimes with dorsoposterior ridge margined with spines or setae. Male first two thoracopods with endite V bearing an apical suctorial organ. Endite IV typical for family, although sometimes broadly transverse or bearing dense, apical setal field. Eggs attaching to prolonged exopods of thoracopods IX and X. Telson without spiniform projection on ventroposterior angle, anteriad of cercopod base. Telson posterior margin spine rows confluent dorsally, with confluence projecting or not. Each row averaging five to 25 spines. Caudal filament originating between spine rows at third, fourth, or fifth spines from confluence. Cercopods arcuate, occasionally sinuate. Cercopod medial surface with longitudinal row of setae along proximal 40 to 60%. Setal row terminates with one spine. Cercopod with subapical, dorsal cirrus, extending 10 to 50% of cercopod length. Eggs 100 to 170 μm in diameter, spherical to subspherical in shape. Eggs with large rectilinear polygonal depressions separated by ridges, occasionally with lamellar or setaform spines at polygon ridge line confluences.

Comments: The type species for the genus is Limnadia stanleyana King, 1855, by monotypy. Recent work has helped us in separating this genus from Eulimnadia (Timms and Rogers 2020). The genus occurs in Australia, New Zealand, and the Celebes Islands.

Attributed Species

Paralimnadia ammopholos Timms, 2016b

Comments: Australia: temporary rainfilled hollows in coastal dunes in northern New South Wales, just south of the Queensland border.

Paralimnadia bishopi Timms, 2016b

Comments: Known only from the type locality on
Cape York, in northern Queensland, Australia. The type locality is in coastal sand dunes.

**Paralimnadia centenaria** (Timms, 2016a) fide Timms and Rogers, 2020
= *Eulimnadia centenaria* Timms, 2016a

*Comments*: Australia: Katherine area of Northern Territory.

**Paralimnadia cygnorum** (Dakin, 1914) *sensu* Timms, 2016b
= *Limnadia cygnorum* Dakin, 1914

*Comments*: Australia: southern Western Australia. The type locality is given as Cannington on the Swan River. The egg is figured by Timms (2016b).

**Paralimnadia datsonae** (Timms, 2015) fide Timms and Rogers, 2020
= *Eulimnadia datsonae* Timms, 2015

*Comments*: Australia: southern Western Australia.

**Paralimnadia feriensis** (Dakin, 1914) *sensu* Timms, 2015, fide Timms and Rogers, 2020
= *Eulimnadia feriensis* Dakin, 1914
= *Limnadia feriensis* (Dakin, 1914)

*Comments*: Western Australia, Australia. Redescribed by Timms (2015).

**Paralimnadia flavia** Timms, 2016b

*Comments*: Extreme northern Western Australia and Northern Territories, Australia.

**Paralimnadia hyposalina** Timms, 2016b

*Comments*: Australia: hyposaline pools in southwestern Western Australia.

**Paralimnadia laharum** Timms, 2018

*Comments*: Australia: Victoria. Endemic to the Grampian Mountains. This species is a rock pool (gnamma) specialist.

**Paralimnadia marplesi** (Timms & McLay, 2005) fide Timms and Rogers, 2020
= *Eulimnadia marplesi* Timms & McLay, 2005

*Comments*: New Zealand. Collected originally in 1962 and not reported since.

**Paralimnadia minyospinosa** Timms & Schwentner, 2020

*Comments*: Australia: New South Wales. Endemic to Gibraltar National Park. This species is a rock pool (gnamma) specialist.

**Paralimnadia monaro** Timms, 2016b

*Comments*: Known only from southern New South Wales, Australia. This species occurs in pools in granitic sands and muddy basalt on the Monaro Plateau. Schwentner et al. (2020b) demonstrate that this species is probably at least two highly endemic species.

**Paralimnadia montana** Timms, 2016b

*Comments*: Australia: northwest New South Wales mountains. Occurs in gnmmas and muddy pools on basalt.

**Paralimnadia multispinosa** Timms, 2016b

*Comments*: Known only from the Payne’s Find area in southern Western Australia, Australia.

**Paralimnadia queenslandicus** Timms, 2016b
= *Paralimnadia* sp. A Schwentner et al., 2015

*Comments*: Queensland and adjacent inland New South Wales, Australia.

**Paralimnadia rivolensis** (Brady, 1886) *sensu* Timms, 2015
= *Eulimnadia rivolensis* Brady, 1886
= *Limnadia rivolensis* (Brady, 1886)
= *Eulimnadia palustera* Timms, 2015 fide Timms and Rogers, 2020

*Comments*: Australia: South Australia, Tasmania, Victoria, Western Australia (Dakin 1914; Gurney 1927). Records for NSW, QLD, and NT in Spencer and Hall are errors. The type locality is given as Rivoli Bay, South Australia. The egg is figured in Timms (2015 and 2016b).

**Paralimnadia saxitalis** Timms, 2016

*Comments*: Australia: one location each in southern Northern Territories (Uluru) and northeast New South Wales (Mt Kaputar). This species is a gnamma (rock pool) specialist.
Paralimnadia sordida (King, 1855) sensu Timms, 2016b
= Limnadia sordida King, 1855
= Eulimnadia sordida (King, 1855)
= Eulimnadia victoriensis Sayce, 1903 fide Timms, 2016b
= Limnadia victoriensisis (Sayce, 1903)

Comments: Coastal portions of New South Wales and Victoria, Australia. The egg is figured by Timms (2016b).

Paralimnadia stanleyana (King, 1855) fide Sars, 1896b, sensu Timms, 2016b
= Limnadia stanleyana King, 1855
= Eulimnadia stanleyana (King, 1855)

Comments: Coastal New South Wales, Australia; other records are likely misidentifications (Timms 2016b). This species is a gnamma (rock pool) specialist on sandstone. The egg is figured and the complex nomenclatural history is discussed by Timms (2016b).

Paralimnadia urukhai (Webb & Bell, 1979) sensu Timms & Schwentner, 2020
= Limnadia urukhai Webb & Bell, 1979
= Limnadia upukhai Webb & Bell, 1979 in error in Shen and Huang 2008

Comments: Timms and Schwentner (2020) redescribed this species, pointing out that there are two genetic lineages. Eastern portion of the New South Wales/ Queensland border region, Australia. This species is a rock pool (gnamma) specialist. Schwentner et al. (2020b) demonstrate that this species is probably two or three highly endemic species.

Although never specifically mentioned in the original description, it would appear that the describers named this species after the Uruk-hai, a fictional breed of half human, half orc (goblin) from J.R.R. Tolkien’s fantasy books, “The Lord of the Rings”.

Paralimnadia vinculuma (Timms, 2015) fide Timms and Rogers, 2020
= Eulimnadia vinculuma Timms, 2015

Comments: Australia: southwestern Western Australia.

Paralimnadia woltrebecki (Brehm, 1933) New Combination
= Eulimnadia woltrebecki (Brehm, 1933)
= Limnadia woltrebecki Brehm, 1933

Comments: Celebes. Reported only once. Based on the drawings by Brehm (1933), this species appears to have the morphological characteristics of Paralimnadia.

Cyzicidae Stebbing, 1910
= Estherianae Packard, 1874
= Estheriidae Sars, 1900
= Caenestheserae Dayad, 1913a: 12 (pro partim)
= Isauridae Bock, 1953
= Bairdestheriidae Novojilov, 1954, in part
= Straskrabiidae Naganawa, 2001b New Combination

Diagnosis: (From Schwentner et al. 2020a). Cephalic fornices extending anteriorly to rostral apex. Rostrum variable, blunt to acute, long or short, generally triangular to subquadrate in lateral view. Rostrum with or without an apical spine. Compound eyes fused medially, sometimes projecting in smoothly arcuate ocular tubercle. Frontal organ sessile. Occipital notch present. Carapace thick, generally rounded. Carapace dorsal margin smooth, lacking carinae, hinge line straight. Carapace with or without pigmentation, growth lines obvious, projecting. Umbone present, projecting well above hinge line. Muscle scar rarely visible. Male first two thoracopods with endopod (sensu Olesen, 2007) lacking an apical suctorial organ or modified tactile setae. If modified setae or spines are present these are never arranged in a transverse apical row of spatulate spines. Telson without a ventroposterior, posteriorly directed spiniform projection. Eggs 110–170 μm in diameter, spherical and generally lacking ornamentation.

Comments: Two genera are recognised here. Daday (1913a: 14) designated Cyzicus as the type genus. Novojilov (1954) created Bairdestheriidae for a large number of fossil genera, among which were Opsipolygrapta and Pseudograpta, and then moved several recent cyzicid species into these genera based on their descriptions. However, the relationships are at best dubious, and no subsequent authors have followed this arrangement.

Cyzicus Audouin, 1837
= Estheria Rüppell in Strauss-Durchheim, 1837 (pro partim), nomen praecocupatum
= Isaura Joly, 1842 nomen praecocupatum
= Caenesthesera Daday, 1914: 106, fide Margalef, 1953, fide Straškraba 1965b
Diagnosis: (From Schwentner et al. 2020a). Populations composed of males and females (except the rostrum which was triangular in character for separating the two genera was the form of support this move (Schwentner et al. 2015 2020a). The Gola (2001) and Orridge (2011). Molecular results Forró and Brtek (1984), Sassaman (1995), Smith and Margelef (1953), Straškraba (1965b), Wiltshire (1973), on morphological and developmental grounds by depending on age and gender. Angle between rostrum and frons 160° to 180°. Occipital notch either deep and narrow, often closed, very shallow or absent. Occipital condyle conical, subacute, length subequal to basal width. Rostral spine generally absent. Carapace valve length ~1.3x valve breadth (umbone to margin). Carapace growth line intervals smooth or ornamented (scarring from algae often mistaken for ornamentation). Carapace typically dark brown, occasionally black, or with yellow markings, often with setae. Clasper endopod apically armed, or with a few setae, apical margin crenulate at most. Endite IV broadly transverse to cylindrical, bearing a dense, apical field of short spiniform setae. Thoracic segments smooth or with a central dorso posterior projection and/or set of spines or setae. Eggs attaching to prolonged exopods of thoracopods IX and X. Thoracopod exopods lacking a triangular lamina. Telson posterior margin posteriolateral spine rows confluent dorsally, with confluence not projecting. Each row has from 10 to 30 spines depending on species. Caudal filament originating between spine rows at fifth, sixth, or seventh spines from confluence. Caudal filament borne or not on projecting mound. Cercopods arcuate, occasionally sinuate, or straight with distal fourth to third bent dorsally. Cercopod with medial longitudinal setal row on proximal 40–60%. Setae plumose and either long or short. Setal row terminates with single spine. Cercopod with subapical, dorsal cirrus, extending from 60–40% of cercopod length. Eggs smooth, unornamented.

Comments: Limnadia tetracerus Krynicki, 1830 is the type species monotypy (Auduoin 1837). Caenestheriella was treated as a junior synonym based on morphological and developmental grounds by Margelef (1953), Straškraba (1965b), Wiltshire (1973), Forró and Brtek (1984), Sassaman (1995), Smith and Gola (2001) and Orridge (2011). Molecular results support this move (Schwentner et al. 2015 2020a). The character for separating the two genera was the form of the rostrum which was triangular in in Caenestheriella, but quadrate in at least male Cyzicus (Daday, 1913a). However, Wiltshire (1973) demonstrated that this was a matter of development at least in Nearctic species; younger animals have a triangular rostrum and older animals a quadrate rostrum, with both forms sexually reproductive.

Tiwari (1966) moved Cyzicus indicus and C. boysii into the fossil genus Baidestheria Raymond, 1946. Baidestheria species are diagnosed as having the carapace intervals bearing radial striae as opposed to punctae. Rogers and Padhye (2015) point out that carapace fine characters may not be diagnostic at genus level, as they are affected by epibiontic algal growth and probably by nutrition.

García and Pereira (2003) state that the Cyzicidae has not been reported from South America; Daday (1914) reported a specimen of C. jonesi from southern South America, and two Cyzicus nomina dubia were described from Brazil, both based on empty carapaces, so their actual placement is questionable.

Many Cyzicus taxa from Africa and Eurasia may be moved to Ozesthehria upon re-examination.

Attributed Species

Cyzicus aegyptiacus Daday, 1914: 290

Comments: Described from Cairo, Egypt, and not reported since. This species needs to be compared with C. ehrenbergi, C. crinitus, C. donaciformis, and C. paradoxus.

Cyzicus algericus Daday, 1914: 261

Comments: Algeria.

Cyzicus belfragei (Packard, 1871)

= Estheria belfragei Packard, 1871
= Caenestheriella belfragei (Packard, 1871)

Comments: Described from Waco, Texas, USA. Mattox (1957b) reported it from Kansas, Oklahoma and Texas. This species needs to be compared with C. mexicanus, C. gynecia and C. morsei. Donald’s (1989) record from Wood-Buffalo National Park, Alberta, Canada needs to be re-examined.

Cyzicus bucheti (Daday, 1913a)

= Caenestheriella bucheti Daday, 1913a nomen nudum
= Caenestheriella bucheti Daday, 1914: 136


Cyzicus californicus (Packard, 1874)

= Estheria californicus Packard, 1874
= Cyzicus newcombii (Baird, 1866)
= Cyzicus setosus (Pearse, 1912)
= *Estheria setosa* Pearse, 1912
= *Caenestheriella setosa* (Pearse, 1912) fide Schwenter et al. 2020a

**Comments:** Redescribed by Daday (1914: 249, 324). Central and northern México, western USA north to Oregon and South Dakota (Mattox 1957b; Maeda-Martínez et al. 2002). California, USA. Packard's (1874) description of *C. californicus* is not useful. The type locality for *C. setosa* is De Witt, Nebraska, USA. This species needs to be compared with *C. elongatus*.

**Cyzicus crinitus** (Thiele, 1900)
= *Estheria crinita* Thiele, 1900: 568
= *Caenestheriella crinita* (Thiele, 1900)
= *Caenestheriella echinata* (Thiele, 1900)
= *Baidestheria crinita* (Thiele, 1900)
= *Baidestheria echinata* (Thiele, 1900)
= *Opsipolygrapta crinita* (Thiele, 1900)
= *Opsipolygrapta echinata* (Thiele, 1900)

**Comments:** This species was originally described from a pool in Tanzania, but has not since been reported from that part of Africa. Daday (1915), Gauthier (1939), and Monod (1969b) report this species from Chad (at Kousssi, on the Cameroon Border), Niger, and Sudan. However, these additional localities are odd disjunct, separated from the Tanzanian locality by the wet tropical zone. This species needs to be compared with *C. ehrenbergi*, *C. donaciformis*, *C. aegyptiacus*, and *C. paradoxus*.

**Cyzicus donaciformis** (Baird, 1849)
= *Estheria donaciformis* Baird, 1849
= *Baidestheria donaciformis* (Baird, 1849)
= *Caenestheriella donaciformis* (Daday, 1913b)
= *Cyzicus echinatus* (Daday, 1913b)
= *Opsipolygrapta echinatus* (Daday, 1913b)

**Comments:** Sudan (Simon 1886). Figured by Daday (1914: 180). This species needs to be compared with *O. crinitus*, *C. ehrenbergi*, *C. aegyptiacus*, and *C. paradoxus*.

**Cyzicus eductus** (Daday, 1913b)
= *Caenestheriella eductus* Daday, 1914: 127
= *Caenestheriella deducta* Daday, 1914 nomen imperfectum in Vecchi 1922

**Comments:** Israel, Syria (Thiéry 1996). This species should be compared with *O. crinitus*, *C. tetraerucus*, *C. gihoni*, *C. hierosolymitana*, *C. ehrenbergi*, *C. donaciformis*, *C. aegyptiacus*, and *C. paradoxus*.

**Cyzicus ehrenbergi** (Daday, 1913b)
= *Caenestheriella ehrenbergi* Daday, 1913b nomen nudum
= *Caenestheriella ehrenbergi* Daday, 1914: 152
= *Caenestheriella ehrenbergi var. dimorpha* Daday, 1914: 152
= *Caenestheriella ehrenbergi var. michaelseni* Daday, 1914: 155
= *Caenestheriella ehrenbergi var. michaelseni* Daday, 1914: 159
= *Cyzicus ehrenbergi var. dimorpha* Daday, 1914: 155
= *Cyzicus dimorphus* (Daday, 1913b)
= *Baidestheria dimorpha* (Daday, 1913b)
= *Baidestheria ehrenbergi* (Daday, 1913b)
= *Caenestheriella ehrenbergi var. fimbriata* Brehm, 1935
= *Cyzicus ehrenbergi var. fimbriata* Brehm, 1935
= *Cyzicus fimbriatus* (Brehm, 1935)
= *Cyzicus ehrenbergi var. michaelseni* (Daday, 1913b)
= *Baidestheria michaelseni* (Daday, 1913b)
= *Cyzicus michaelseni* (Daday, 1913b)

**Cyzicus elongatus** Mattox, 1957b

**Comments:** California, USA. This species needs to be compared with *C. californicus*.

**Cyzicus gifuensis** (Ishikawa, 1895)
= *Estheria gifuensis* Ishikawa, 1895
= *Caenestheriella gifuensis* (Ishikawa, 1895)

**Comments:** Japan. The type locality is Mino, Gifu Province. Figured by Daday (1914: 125).

**Cyzicus gihoni** (Baird, 1859)
= *Estheria gihoni* Baird, 1859

**Comments:** Israel, Lebanon (Baird 1859, Simon 1886, Daday 1914: 300). This species should be compared with *C. tetraerucus*, *C. grubei*, *C. hierosolymitana*, *C. paradoxus*, *C. ehrenbergi*, *C. donaciformis*, *C. aegyptiacus*, and *O. crinitus*.

**Cyzicus grubei** (Simon, 1886) *sensu* Alonso, 1996
= *Estheria grubei* Simon, 1886
Caenestheria syriaca nomen nudum Daday, 1913b
= Caenestheria syriaca Daday, 1914: 62
= Caenestheria grubei Daday, 1914: 131
= Eocyzicus syriacus (Daday, 1914) (fide Brtek, 1997)

Comments: Mediterranean region (Daday 1913–1914; Alonso 1996; Machado et al. 1999; Perez-Bote 2004). Alonso (1996) redescribed this species, providing excellent drawings. The type locality for C. grubei is Spain, at Ciudad Real, and Alonso (1996) reports the species as endemic to arid regions of the Iberian Peninsula and the Balearic Islands. Daday (1915) gave records from modern Israel and Syria. This species should be compared with C. gihoni and C. hierosolymitana.

Cyzicus gynecius (Mattox, 1950)
= Caenestheriella gynecius Mattox, 1950

Comments: Massachusetts, New Jersey, New York, Ohio, and Pennsylvania USA (Schmidt and Kiviat 2007; Smith and Gola 2001; Orridge 2011). Apparently males are absent. This species needs to be compared with C. mexicanus, C. belfragei and C. morsei. The eggs are spiny (Smith and Gola 2001).

Cyzicus hierosolymitanus (Fischer, 1860)
= Estheria hierosolymitanus Fischer, 1860
= Cyzicus hierosolymitanus var. rollei Daday, 1914: 322 nomen dubium

Comments: Israel, Jerusalem (Simon 1886). Should be compared with C. gihoni. Both may be synonyms of C. tetracerus, which Daday (1914) says is very similar. Redescribed by Daday (1914: 312). Daday’s form rollei (1914) was only known from empty carapaces.

Cyzicus jonesi (Baird, 1862)
= Estheria jonesi Baird, 1862

Comments: Cuba (Baird 1849; Daday 1914: 240), although Daday mentions one collection from “America Meridionalis”, which is basically tropical and southernmost America. Packard (1874) had material given to him without locality data and suggested the specimens came from the southern USA or Central America. The types were deposited in the Berlin Museum.

Cyzicus ludhianatus (Battish, 1981)
= Caenestheriella ludhianata Battish, 1981

Comments: India: Punjab; reported once. Probably a synonym of C. annandalei (Rogers and Padhye 2015).

Cyzicus madagascariaca (Daday, 1914)
= Caenestheriella madagascariaca Daday, 1914
= Pseudograpta madagascariaca (Daday, 1914)

Comments: Madagascar. See comments under C. ruber.

Cyzicus mexicanus (Claus, 1872)
= Estheria mexicanus Claus, 1872
= Estheria culpwelli Baird, 1862 (fide Simon, 1886)
= Estheria dunkeri Baird, 1862 (fide Packard, 1883)
= Estheria clarki Packard, 1874 (fide Simon, 1886)
= Cyzicus seurati Daday, 1914: 265 (fide Maeda-Martínez et al., 2002)

Comments: Central and northern México, central and eastern USA, and Canada in Alberta and Manitoba (Packard 1874; Daday 1914; Mattox 1957b; Wolfe 1982; Maeda-Martínez et al. 2002). Redescribed by Daday (1914: 252). Maeda-Martínez et al. (2002) state that C. seurati is a junior synonym. However, Daday (1914) states that the egg is covered in spines similar to that observed in C. jonsei. The types of C. seurati are in the Paris Museum and the eggs should be compared with those of C. mexicanus and C. californicus. Packard’s E. clarki description is not useful, but material was deposited at the Chicago Museum, and thus is no longer extant. This species needs to be compared with C. belfragei, C. gynecia and C. morsei.

Cyzicus morsei (Packard, 1871)
= Estheria morsei Packard, 1871
= Caenestheriella morsei (Packard, 1871)

Comments: Described originally from Iowa, USA (Packard 1871). Other records come from Oklahoma, Nebraska (Mattox 1957b), and South Dakota (Packard 1874). Daday (1915: 140) provides a figure. This species needs to be compared with C. mexicanus, C. gynecia and C. belfragei. Packard’s description is not useful.

Cyzicus nepalensis Uéno, 1967

Comments: Nepal. Uéno (1967) did not designate types, nor state where his material was deposited, but did suggest that his species may be conspecific with C. annandalei. However, the cercopods depicted in the original description appear distinct from those of other Indian species (Rogers and Padhye 2015).
Cyzicus politus (Baird, 1849)
= Estheria polita Baird, 1849

Comments: India. The type locality is given as: “India”.

Cyzicus rubra (Daday, 1913b)
= Caenestheriella rubra Daday, 1913b nomen nudum
= Caenestheriella rubra Daday, 1914: 146
= Caenestheriella rubra var. acanthoporus Brehm, 1958
= Cyzicus ruber var. acanthoporus (Brehm, 1958)

Comments: Madagascar. This species needs to be compared closely with C. madagascarica, which Daday separates on differences of the carapace and abdominal dorsal spines.

Cyzicus sinensis Hu, 1988b

Cyzicus tetracerus (Krynicki, 1830) fide Audouin, 1837
= Limnadia tetracerus Krynicki, 1830
= Estheria tetracerus (Krynicki, 1830)
= Isaura cycladoideis Joly, 1842
= Estheria cycladoideis (Joly, 1842)
= Isaura tetracerus (Krynicki, 1830)
= Cyzicus cycladoideis (Joly, 1842)
= Cyzicus borceai Daday, 1914: 257
= Cyzicus chyzeri Daday, 1913b: 40
= Cyzicus dubiosus Daday, 1913b: 292
= Cyzicus fallax Daday, 1914: 275
= Cyzicus hungaricus Daday, 1913: 25
= Cyzicus intermedius Daday, 1913: 36
= Cyzicus romanus Daday, 1914: 244
= Cyzicus sibericus Daday, 1913b: 296
= Cyzicus similis Daday, 1914: 305
= Caenestheriella variabilis Daday 1913b: 17, fide Brtek & Thiéry, 1995
= Caenestheriella cyrenaicus Vecchi, 1922
= Cyzicus cyrenaicus (Vecchi, 1922)
= Cyzicus ornatus Smirnov, 1932

Comments: The type locality is in the vicinity of Kharkiv (Charkov), Ukraine. Widespread and common: Albania, Algeria, Armenia, Azerbaijan, Czech Republic, Egypt, France, Georgia, Hungary, Italy, Poland, Romania, Russia (east through Siberia and into the arctic circle), Serbia, Spain, Tunisia, Turkey, Ukraine, Uzbekistan; “Central Sahara” (Thiele 1900; Gurney 1909; Daday 1913b 1914; Gauthier 1938; Cottarelli 1971; Šrámek-Hušek et al. 1962; Vekhov 1974; Lebedeva 1982; Stoicescu 2004). Type species of the genus by monotypy (Mattox 1957b). Joly (1842) and Alonso (1996) provide excellent drawings. Daday (1914) states that C. sibericus is intermediate among several other taxa that were subsequently treated as synonyms of C. tetracerus. Daday (1914) reported C. simoni only from one locality in Lebanon (Beirut), but that it was very similar to C. tetracerus. Cyzicus ornatus was reported from Siberia. Cyzicus variabilis was redescribed by Stoicescu (2004) and presented as a valid species. However, it should be re-examined using modern standards.

Nomina dubia, nuda, and species inquirendae

Cyzicus boysii (Baird, 1849) nomen dubium fide Rogers & Padhye 2015
= Estheria boysii Baird, 1849
= Caenestheriella boysii (Baird, 1849) fide Daday 1914
= Caenestheriella similis (Baird, 1849) fide Daday 1914
= Bairdestheria similis (Baird, 1849)
= Pseudograpta boysii (Baird, 1849)
= Bairdestheria boysii (Baird, 1849) in Tiwari 1996
= Cyzicus similis (Baird, 1849) fide Rogers & Padhye 2015
= Estheria similis Baird, 1849
= Bairdestheria similis (Baird, 1849)
= Pseudograpta similis (Baird, 1849)

Comments: The type locality is given as “India”. Tiwari (1996) treats C. annandalei and associated synonyms, as well as C. similis all as junior synonyms of C. boysii. However, Rogers and Padhye (2015) reported that the types of C. boysii and C. similis are empty, dried carapaces; useless for determination. Furthermore, Daday (1914) was unable to differentiate between the two forms, and could not separate the types from any other Eurasian form, and treated both taxa as species inquirendae. Baird’s description of these two species is entirely based on carapace characters, giving the type locality for both as “India”.

Cyzicus brasiliensis (Baird, 1849) nomen dubium fide Daday 1914: 327
= Estheria brasiliensis Baird, 1849

Comments: “Brazil”. Description based on empty carapace.
**Cyzicus bravaisii** Audouin, 1837 *nomen nudum* fide Todd, 1952

*Comments*: Audouin mentions this name once, but provides no description or data and does not refer to any specimens.

**Cyzicus caldwelli** (Baird, 1852) *nomen dubium* fide Daday 1914: 328

= *Estheria caldwelli* Baird, 1852

*Comments*: Lake Winnipeg, Canada. Description based on carapace.

**Cyzicus dallasi** (Baird, 1852) *nomen dubium* fide Daday 1914: 329

= *Estheria dallasi* Baird, 1852

*Comments*: “Brazil”. Description based on carapace.

**Cyzicus gubernator** (Klunzinger, 1864) *species inquirenda* fide Daday 1914

= *Limnadia gubernator* Klunzinger, 1864

= *Caenestheriella gubernator* (Klunzinger, 1864)

*Comments*: Described from Egypt (Simon 1886). Daday (1914) states that the description is barely sufficient to place this taxon in *Caenestheriella* (among the taxa that were eventually moved to *Cyzicus*).

**Cyzicus lofti** (Baird, 1862) *nomen dubium* fide Daday 1914: 326

= *Estheria lofti* Baird, 1862

*Comments*: Type locality is Bagdad, Iraq. Description based on empty carapaces.

**Cyzicus melitensis** (Baird, 1849) *nomen dubium* fide Daday 1914: 325

= *Estheria melitensis* Baird, 1849

*Comments*: Malta, Sicily (Simon 1886). Description based on empty carapaces.

**Cyzicus paradoxus** (Daday, 1914) *nomen dubium*

= *Caenestheriella paradoxa* Daday, 1914: 110

= *Bairdestheria paradoxa* (Daday, 1914)

= *Baidestheria paradoxa* (Daday, 1914)

*Comments*: Description based on juvenile specimens. The type locality is given as the Niger River Valley in western Africa. Monod (1969b) reports one male and three females from Sanga, in southern Mali, but stated the determination was problematic. Barnard (1935) states that this taxon is a juvenile *Ozestheria australis*. However, *O. australis* is unknown outside of southern seasonally dry Africa.

**Cyzicus politus** (Baird, 1849) *nomen dubium* fide Daday 1914: 327

= *Estheria polita* Baird, 1849

= *Eocyzicus politus* (Baird, 1849)

*Comments*: Types are empty, dry carapaces and the description is based solely on carapace details.

**Ozestheria** Schwentner & Richter, in Schwentner, Just, & Richter, 2015

= *Caenestheria* Daday, 1914: 53 (pro partim)

= *Opsipolygrapta* Novojilov 1954 (pro partim)

*Diagnosis*: (modified from Schwentner et al. 2015). Populations composed of males and females; amplexus is venter to venter. Male and female rostrum triangular, rostral spine generally absent (sometimes present in *O. australis*). Ocular tubercle smoothly arcuate. Angle between rostrum and frons 150° to 170°. Occipital condyle either short and rounded or elongated and subacute. Carapace valve length ~1.5 times valve breadth (hinge to margin). Carapace with or without sculpturing between growth lines (scarring from algae often mistaken for sculpture). Carapace typically dark brown. Male thoracopod I with endopod bearing one or more transverse apical rows of flattened, broadly subtriangular denticles (claw-like scales). Endite IV broadly transverse to cylindrical, bearing a dense, apical field of short spiniform setae. Eggs attaching to prolonged exopods of thoracopods IX and X. Thoracopod exopods lacking a triangular lamina. Posterior trunk segments with several medial dorsoposterior spines per segment. Telson posterior margin posteriolateral spine rows confluent dorsally, with confluence not projecting. Each row with 10 to 30 spines. Caudal filament originating between spine rows at fifth, sixth, or seventh spines from confluence. Caudal filament borne on projecting mound or not. Cercopods sinuate to curved. Cercopod with medial longitudinal setal row on proximal 40–60%. Setae plumose and either long or short. Setal row terminates with single spine. Cercopod with subapical, dorsal cirrus, extending from 40 to 60% of cercopod length.

*Comments*: *Ozestheria lutraria* (Brady, 1886) is the type species by designation. Until now the genus was thought limited to Australia. Review of material and original descriptions, plus the molecular analyses presented in Schwentner et al. (2020a), reveals that the
genus extends into Asia and Africa. Many *Cyzicus* taxa from Africa and Eurasia may be moved to *Ozestheria*
upon re-examination. *Ozestheria packardi* appears to be a complex of species (Schwentner et al. 2015).

Novojilov (1954) erected *Opsipolygrapta* designating *Caenestheriella packardi* as the type. Chen and Shen (1985) list *Opsipolygrapta* as an invalid name.

**Attributed Species**

**Ozestheria altus** (Shu, Rogers, Chen, & Yang, 2015) New Combination

= *Cyzicus altus* Shu, Rogers, Chen, & Yang, 2015

Comments: Yunnan Province, China. Known only from the type locality.

**Ozestheria annandalei** Daday, 1913b New Combination

= *Caenestheriella annandalei* Daday, 1913b
= *Cyzicus annandalei* (Daday, 1913b)
= *Baidestheria annandalei* (Daday, 1913b)
= *Caenestheriella roonwalli* Tiwari, 1962, fide Tiwari, 1996
= *Caenestheriella misrai* Tiwari, 1962, fide Tiwari, 1996
= *Cyzicus misrai* (Tiwari, 1962) fide Tiwari, 1996

Comments: Temperate regions of northern India (Rogers and Padhye 2015). Figured by Daday (1915: 166) and Tiwari (1962: 184).

**Ozestheria australis** Lovén, 1847 New Combination

= *Caenestheria australis* (Lovén, 1847)
= *Caenestheriella australis* (Lovén, 1847)
= *Baidestheria australis* (Lovén, 1847)
= *Eocyzicus australis* (Lovén, 1847)
= *Estheria elizabethae* Sars, 1898a fide Wolf in Daday, 1914
= *Baidestheria elizabethae* (Sars, 1898a)
= *Caenestheriella joubini* Daday, 1913b *nomen nudum*, fide Barnard, 1929
= *Opsipolygrapta joubini* (Daday, 1913b)
= *Caenestheriella joubini* Daday, 1914: 148
= *Caenestheriella vidua* Daday, 1914: 122, fide Barnard, 1929

Comments: Widespread and very common in Botswana, Lesotho, Namibia, South Africa, Zimbabwe (Sars 1898a b; Gurney 1904; Daday 1914; Barnard 1935; Brehm 1958; Brendonck 1999; Nhwatiwa et al. 2014; Mabidi et al. 2016; Milne et al. 2020). Figured in Sars (1898a) and Daday (1914: 99, 123, 176).

**Ozestheria berneyi** (Gurney, 1927)

= *Estheria berneyi* Gurney, 1927
= *Caenestheria berneyi* (Gurney, 1927)
= *Eocyzicus berneyi* (Gurney, 1927)

Comments: Australia: Queensland, and adjacent New South Wales and South Australia (Timms and Richter 2002).

**Ozestheria dictyon** (Spencer & Hall, 1896)

= *Caenestheria dictyon* Spencer & Hall, 1896

Comments: Australia: Northern Territory. Known only from the type locality at Palm Creek in the James Range (Timms and Richter 2002). Sayce (1903) suggested that this taxon was a juvenile form of *O. lutraria*.

**Ozestheria elliptica** (Sars, 1896)

= *Estheria elliptica* Sars, 1896
= *Caenestheria elliptica* (Sars, 1896)
= *Cyzicus ellipticus* (Sars, 1896)
= *Eocyzicus ellipticus* (Sars, 1896)

Comments: Australia: Western Australia. Only known from the type locality, at Roebuck Bay (Timms and Richter 2002). Refigured by Daday (1915: 97).

**Ozestheria indica** (Gurney, 1906) New Combination

= *Caenestheriella indica* Gurney, 1906
= *Cyzicus indicus* (Gurney, 1906)
= *Baidestheria indicus* (Gurney, 1906)
= *Opsipolygrapta indica* (Gurney, 1906)


**Ozestheria lutraria** (Brady, 1886)

= *Estheria lutraria* Brady, 1886
= *Caenestheria lutraria* (Brady, 1886)
= *Estheria dictyon* Spencer & Hall, 1896 (fide Sayce, 1903)
= *Cyzicus lutraria* (Brady, 1886)
= *Cyzicus dictyon* (Spencer & Hall, 1896)
= *?Caenestheria dictyon* (Spencer & Hall, 1896)
= *Eocyzicus lutrarius* (Brady, 1886)

Comments: Australia: New South Wales, South Australia, Queensland. The type locality for *lutraria* is at Innaminka, South Australia, near the Queensland
Ozestheria mariae (Olesen & Timms, 2005)
= Caenestheriella mariae Olesen & Timms, 2005

Comments: Australia: Western Australia. This is a rock pool (gnamma) specialist. The type locality is Bushfire Rocks near Hyden.

Ozestheria packardi (Brady, 1886)
= Estheria packardi Brady, 1886
= Cyzicus (Estheria) packardi (Brady, 1886)
= Caenestheriella packardi (Brady, 1886)
= Cyzicus packardi (Brady, 1886)
= Estheria packardi var. typica Spencer & Hall, 1896
= Caenestheriella packardi var. typica (Spencer & Hall, 1896)
= Cyzicus packardi var. typica (Spencer & Hall, 1896)
= Estheria packardi var. cancellata Spencer & Hall, 1896
= Caenestheriella packardi var. cancellata (Spencer & Hall, 1896)
= Cyzicus packardi var. cancellata (Spencer & Hall, 1896)
= Estheria packardi var. minor Spencer & Hall, 1896
= Caenestheriella packardi var. minor (Spencer & Hall, 1896)
= Cyzicus packardi var. minor (Spencer & Hall, 1896)
= Opsipolygrapta packardi (Brady, 1886)
= Baidestheria packardi (Brady, 1886)
= Baidestheria var. typica (Spencer & Hall, 1896)
= Baidestheria var. cancellata (Spencer & Hall, 1896)

Comments: Arid and semiarid Australia. The type locality is Lake Bonney, SA, between Adelaide and the New South Wales border. Figured by Daday (1915: 118). Appears to represent a complex of at least 14 species (Schwentner et al. 2015).

Ozestheria pellucida Timms, 2018

Comments: Australia: Western Australia. Endemic to the Gardner Plateau. This species is a rock pool (gnamma) specialist.

Ozestheria pilosa (Rogers, Thaimuangphol, Saengphan, & Sanoamuang, 2013)
= Cyzicus pilosus Rogers, Thaimuangphol, Saengphan, & Sanoamuang, 2013

Comments: Laos, Myanmar, Thailand.

Ozestheria rubra (Henry, 1924)
= Estheria rubra Henry, 1924
= Caenestheria rubra (Henry, 1924)
= Cyzicus rubra (Henry, 1924)

Comments: Australia: southern Northern Territory, northern South Australia, and western portions of Queensland and New South Wales (Schwentner et al. 2015).

Ozestheria sarsii (Sayce, 1903)
= Estheria sarsii Sayce, 1903
= Cyzicus sarsi (Sayce, 1903)
= Cyzicus sarsii (Sayce, 1903)
= Caenestheria sarsi (Sayce, 1903)
= Estheria sarsii (Sayce, 1903)
= Eocyzicus sarsii (Sayce, 1903)

Comments: Australia: South Australia and Western Australia (Timms and Richter 2002, Schwentner et al. 2015). The type locality is given as Boulder City (near Kalgoorlie). Figured by Daday (1915: 57). No types were designated.

Species inquirenda

Ozestheria rufa (Dakin, 1914) species inquirenda
= Cyzicus (Estheria) rufa Dakin, 1914
= Caenestheria rufa (Dakin, 1914)
= Eocyzicus sp. Brtek, 1997

Comments: Australia: Western Australia (Timms and Richter 2002). Based on two females and not collected since.

Eocyzicidae Schwentner, Rabet, Richter, Giribet, Padhye, Cart, Bonillo, and Rogers, 2020
= Caenestheriidae Daday, 1913b: 12 (pro partim)
= Baikalolkhoniinae Naganawa, 1999
= Baikalolkhoniidae Naganawa, 1999 New Combination

Diagnosis: (Modified from Rogers et al. 2017; and Schwentner et al. 2020a). Populations composed of males and females; amplexus is venter to venter. Rostrum typically sexually dimorphic. Rostrum subtriangular (usually females) to subquadrate (usually males) or rounded. Rostrum may or may not be armed with an apical spine (sometimes present in juveniles and rarely adults). Angle between rostrum and frons 170° to
190°. Occipital notch very shallow or absent. Occipital condyle low, rounded or absent, length half or less basal width. Carapace valve length ~1.5 times valve breadth (hinge to margin). Carapace growth line intervals smooth or ornamented (scarring from algae often mistaken for ornamentation). Carapace typically brown, occasionally black, sometimes with marginal setae. Clasper endopod apically with a transverse row of one to a few apical scales bearing a marginal fringe. Endite IV broadly transverse to cylindrical, bearing a dense, apical field of short spiniform setae. Thoracic segments smooth or with a central dorsoposterior projection and/or set of spines or setae. Eggs attaching to prolonged exopods of thoracopods IX and X. Thoracopod epipods lacking a triangular lamella. Telson posterior margin posteriolateral spine rows confluent dorsally, with confluence not or slightly projecting. Each row has from six to 30 spines depending on species and gender. Females typically have more and smaller spines than males. Caudal filament originating between spine rows at fifth, sixth, or seventh spines from confluence. Caudal filament borne on projecting mound. Cercopods arcuate or straight. Cercopod with a dorsomedial longitudinal row of setae or spines on proximal 40 to 60%. Setae plumose and either long or short. Row terminates with single spine. Cercopod with subapical, dorsal cirrus, extending from 50 to 40% of cercopod length. Eggs smooth or with surface polygons.

Comments: Two genera are recognised. Naganawa (2001b) treated *Eocyzicus* as a junior synonym of *Cyzicus*, however this is not supported by molecular studies (Schwentner et al. 2009; Schwentner et al. 2020a). Naganawa (1999) created Baikalolkhoniinae to accommodate a new species of cyzicid clam shrimp from Russia. Brtek (2002) elevated that taxon to family status with no explanation or justification.

Tiwari (1966) reported a rostral spine in some large adult *E. bouvieri*. 

*Rogers et al.* (2017) provided a review of the genus.

### Attributed Species

**Eocyzicus argillaquus Timms & Richter, 2009**

= *Eocyzicus* sp. B Timms & Richter, 2002

*Comments*: Australia: New South Wales, Northern Territory, South Australia, Queensland, and Western Australia.

**Eocyzicus armatus Tippelt & Schwentner, 2018**

= *Eocyzicus* lineage Z Schwentner et al., 2013

*Comments*: Australia: New South Wales, Northern Territory, Western Australia.

**Eocyzicus bouvieri** (Daday, 1914: 201) fide Padhye & Rabet, 2017

= *Eocyzicus perrieri* Dayad, 1913b nomen nudum

= *Eocyzicus pellucidus* Tiwari, 1962, fide Tiwari, 1996

= *Eocyzicus maliricus* Qadri & Baqai, 1956, fide Tiwari, 1996

= *Eocyzicus acuta* Nayar, 1965 nomen dubium fide Tiwari, 1996

= *Eocyzicus* sp. Karande & Inamdar, 1965 fide Rogers & Padhye, 2015

*Comments*: Siberian Russia to Pakistan and northern India (Daday 1914; Rogers and Padhye 2015). Redescribed by Padhye and Rabet (2017). Originally reported from Himachal Pradesh, India (Daday 1913b), Dayad later (1914: 104) stated in the description that this species is from Russia, specifically Tobolsk (just north of Kazakhstan) and Obdorsk, now called Salekhard, on the Arctic Circle. Padhye and Rabet (2017) re-examined the types. The description of *E. acuta* based upon juvenile females. It should be pointed out that *E. bouvieri* is not the same as *C. bouvieri*. This species should be compared with *E. orientalis* and *E. zugmayeri*.

**Eocyzicus breviantennus** Tippelt & Schwentner, 2018

= *Eocyzicus* lineage S Schwentner et al., 2013

*Comments*: South Australia, Australia. Known only from the type locality: 26°59'48.9"S, 133°24'55.2"E.
**Eocyzicus careyensis** Tippelt & Schwentner, 2018

= *Eocyzicus* lineage R Schwentner et al., 2013

**Comments:** Known only from the type locality. Australia: Western Australia, Lake Carey, 29°10’S, 122°20’E.

**Eocyzicus consors** (Daday, 1914)

= *Caenestheria consors* Daday, 1913b nomen nudum
= *Caenestheria consors* Daday, 1914: 66
= *Caenestheria inmssi* Daday, 1914 nomen nudum
= *Caenestheria inmssi* Daday, 1914: 78
= *Caenestheria skorikowi* Daday, 1913b nomen nudum
= *Caenestheria skorikowi* Daday, 1914: 82

**Comments:** The type locality for *consors* is modern Uzbekistan. This species should be compared with *E. sahlbergi* and *E. davidi*. This species is reported from Uzbekistan through northeastern India. Daday (1914) commented on the close similarity of all these forms; their differences appear to be very slight.

**Eocyzicus davidi** (Simon, 1886)

= *Caenestheria davidi* (Simon, 1886)
= *Caenestheria bouvieri* Daday, 1914: 100
= *Caenestheria bouvieri* Daday, 1914
= *Caenestheriella kawamurai* Uéno, 1926
= *Eocyzicus kawamurai* (Uéno, 1926)
= *Eocyzicus mongolianus* Uéno, 1927
= *Eocyzicus laiyangensis* Hu, 1985, fide Naganawa & Orgiljanova, 2000
= *Eocyzicus shiquanicus* (Hu, 1991)

**Comments:** The type locality is given as “China, Peking” for both *E. davidi* and *E. kawamurai*. Additional records are from arid China (Tibet, Inner Mongolia) and Mongolia (Sars 1901; Gurney 1906; Hu 1993a). It is figured by Daday (1914: 73, 100) and Dong et al. (1982: 11). Brtek (1997) synonymised *E. bouvieri* with *E. davidi*; it should be pointed out that *C. bouvieri* is not the same as *E. bouvieri*. *Eocyzicus mongolianus* was described from two female specimens collected from near Mukden, now called Shenyang, in Liaoning Province (also partially figured in Dong et al. 1982), and *E. yanzhouensis*, *E. shiquanicus*, and *E. laiyangensis* are each only known from their respective type localities in Shandong Province. All four were reported from north eastern China, between Mongolia and the Korean Peninsula. *Eocyzicus laiyangensis* may be conspecific with *E. orientalis* based on general morphology (Rogers et al. 2017); however, Naganawa and Orgiljanova (2000) treated it as *E. davidi*, along with *E. kawamurai*, and *E. shiquanicus*. However, it does not appear that any material was examined by them (Rogers et al. 2017). Simon (1886) and Sars (1901) separated *E. davidi* from *E. sahlbergi* using highly variable characters: carapace outline, growth line number, first antennae form, and second antennal flagellae number of antennomeres. This species needs to be closely compared with *E. orientalis*.

**Eocyzicus dentatus** Barnard, 1929: 261

**Comments:** Known from a single male specimen, collected from Cape Province, South Africa, from the same locality (possibly the same pool) as *E. obliqua*. Figured by Brendonck (1999). This form is very distinctive.

**Eocyzicus digueti** (Richard, 1895)

= *Estheria digueti* Richard, 1895
= *Eocyzicus vanhoefeni* Daday, 1913b: 210
= *Estheria concava* Mackin, 1939 nomen nudum
= *Eocyzicus concavus* (Mackin, 1939) sensu Mattix, 1954b

**Comments:** Widespread and common in northern México, southwestern USA (Maeda-Martínez et al. 2002; Rogers and Hann 2016; Rogers et al. 2017). Figured by Daday (1914: 194). Mackin included *E. concavus* in an identification key, but never described the species as the specimens were lost. New topotype material was sent by Mackin to Mattix who subsequently described the taxon (1954b).

**Eocyzicus gigas** Barnard, 1924: 226

= *Estheria gigas* (Barnard, 1924)

**Comments:** Namibia, South Africa (Kalahari Desert and North Cape) (Barnard 1935; Brehm 1958; Milne et al. 2020). Should be compared with *E. obliquus*. More details are provided by Barnard (1929 1935) and Brehm (1958). Figured by Brendonck (1999).

**Eocyzicus hutchinsoni** Bond, 1934 species complex fide Rogers & Padhye, 2015

= *Eocyzicus deterrana* Bond, 1934
= *Eocyzicus deterrana* Bond, 1934
= *Eocyzicus kashmirensis* Qadri & Baqai, 1956 nomen dubium, fide Rogers and Padhye, 2015
= *Eocyzicus wulari* Das & Akhtar, 1971 nomen dubium, fide Rogers and Padhye, 2015

**Comments:** Northern India. Reviewed in detail in Rogers and Padhye (2015) and Padhye and Lazo-

**Eocyzicus inopinatus** (Daday, 1914)

= *Caenestheria inopinata* Daday, 1913b *nomen nudum*
= *Caenestheria inopinata* Daday, 1914: 69

**Comments:** The type locality is given as “Jerusalem”. It has not been reported since.

**Eocyzicus irritans** Daday 1914: 218

= *Eocyzicus irritans* Wolf (in litteris) Daday, 1914 *nomen dubium*
= *Cyzicus irritans* Wolf (in Daday, 1914)

**Comments:** The type locality is given as Sudan, but Daday (1914) says it occurs in equatorial Africa. Margalef (1948) reported this taxon from Western Sahara (Sahara Español). Wolf deposited material in the Vienna Museum, under the name “*Cyzicus irritans*”, but never published a description (Daday 1914). This species should be compared with *E. saharica*, *E. latirostris*, *E. zugmayeri*, and *E. orientalis*.

**Eocyzicus klunzingeri** Daday 1914: 197

= *Eocyzicus klunzingeri* Wolf (in litteris) in Daday, 1914 *nomen dubium*
= *Estheria klunzingeri* Wolf (in Daday, 1914)
= *Cyzicus klunzingeri* Wolf (in litteris) in Daday, 1914 *nomen nudum*

**Comments:** Sudan. Wolf deposited material in the Vienna Museum, under the names “*Cyzicus klunzingeri*” and “*Cyzicus lobatus*”, but never published descriptions (Daday 1914). Monod (1969b) claimed to have material from Mauritania, on the opposite side of Africa from the only know locality for this taxon, stating that the determination was tentative. This species should be compared with *E. saharica*, *E. zugmayeri*, *E. latirostris*, and *E. orientalis*.

**Eocyzicus latirostris** Daday, 1914: 225

= *Eocyzicus latirostris* Daday, 1913 *nomen nudum*

**Comments:** Senegal. The types were deposited at the Paris Museum. This species should be compared with *E. saharica*, *E. irritans*, *E. zugmayeri*, *E. klunzingeri*, *E. mesopotamiensis*, and *E. orientalis*.

**Eocyzicus mesopotamiensis** Mohammad, 1985

**Comments:** Iraq. Known only from the type locality, north of Baghdad. This species should be compared with *E. orientalis*, *E. saharica*, *E. irritans*, *E. zugmayeri*, *E. klunzingeri*, and *E. latirostris*.

**Eocyzicus occidentalis** Tippelt & Schwentner, 2018

= *Eocyzicus* lineage Q Schwentner et al., 2013

**Comments:** Known only from the type locality: Muggon Claypan, near Carnavon, Western Australia.

**Eocyzicus obliquus** (Sars, 1905)

= *Estheria obliqa* Sars, 1905
= *Cyzicus obliquus* (Sars, 1905)

**Comments:** Southern Africa (Mabidi et al. 2016; Milne et al. 2020). The type locality is “Hanover, Cape Colony”. Redescribed by Daday (1914: 222). Should be compared with *E. gigas*. Figured by Brendonck (1999).

**Eocyzicus orientalis** Daday, 1914: 205, *sensu* Dobrynina, 2004

= *Eocyzicus orientalis* Daday, 1913b: 90 *nomen nudum*
= *Eocyzicus yanzhouensis* Hu, 1993a, fide Naganawa & Orgiljanova, 2000
= *Eocyzicus paralayangensis* Hu, 1992, fide Naganawa & Orgiljanova, 2000

**Comments:** China, Arabia, Afghanistan, Armenia, Azerbaijan, Georgia, northern and central India, Iran, Moldova, Turkmenistan, Ukraine, Uzbekistan, southern Russia, Syria (Daday 1914; Hu 1993a; Dobrynina 2004). Redescribed by Dobrynina (2003 2004). Naganawa and Orgiljanova (2000) synonymized *E. paralayangensis* with *E. orientalis*. This species should be compared with *E. davidi*, *E. irritans*, *E. zugmayeri*, *E. latirostris*, *E. klunzingeri*, and *E. saharicus*. Dobrynina (2004) suggests that *E. orientalis* was introduced to the eastern European Steppe Zone by fish farming, through fish larvae imported from Transcaucasia. This species should be compared to *E. davidi* and *E. sahlbergi*. Rogers and Padhye (2015) suggest that Daday’s (1915) *E. orientalis* record from tropical India may be a misidentification.

**Eocyzicus parooensis** Richter & Timms, 2005

= *Limnadia* sp. b, Timms, 1993
= *Eocyzicus* sp. a, Timms & Richter, 2002

**Comments:** New South Wales, Northern Territory, South Australia, Queensland, and Western Australia. The type locality is Gidgee Lake on Bells Creek, on Bloodwood Station. This species occurs in hyposaline basins.
Eocyzicus parvus Tippelt & Schwentner, 2018
= Eocyzicus lineage T Schwentner et al., 2013

Comments: Queensland, Australia. Known only from the type locality: 27°58'26.8"S, 144°18'34.9"E.

Eocyzicus phytophilus Tippelt & Schwentner, 2018
= Eocyzicus lineage Y Schwentner et al., 2013

Comments: Australia: New South Wales, South Australia, Queensland.

Eocyzicus plumosus Royan & Sumitra, 1973
= Eocyzicus palpalis Simhachalam & Timms, 2012

Comments: Southern India and Sri Lanka. Type locality for E. plumosus given as: India, Racharla Mandal, Prakasam District. Pool at Racharla (15°28'N, 78°58'E). Reviewed in Rogers and Padhye (2015): Eocyzicus plumosus is known only from the original description, which is inadequate, and no types were deposited. Both taxa are reported from the same region and the same saline habitat types, and the minor differences between the two forms are likely age dependant (Rogers and Padhye 2015).

Eocyzicus richteri Tippelt & Schwentner, 2018
= Eocyzicus lineage X Schwentner et al., 2013

Comments: Australia: New South Wales, South Australia, Queensland.

Eocyzicus saharica (Gauthier, 1937)
= Estheria saharica Gauthier, 1937
= Eocyzicus saharicus (Gauthier, 1937)

Comments: Described from a pool near Agueraktem well, in Adrar Province, Mauritania (Gauthier 1937 1938). Gauthier later (1939) reported some possible subadults from eastern Chad. Thiéry (1986) reports this species from Morocco. This species should be compared with E. irritans, E. zugmayeri, E. latirostris, E. klunzingeri, and E. orientalis.

Eocyzicus sahlbergi (Simon, 1886)
= Estheria sahlbergi Simon, 1886
= Estheria propinquus Sars, 1901
= Eocyzicus propinquus (Sars, 1901)
= Caenestheria siberica Daday, 1913b nomen nudum
= Caenestheria sibericus Daday, 1914: 59
= Baidestheria siberica (Daday, 1913b)
= Eocyzicus sibericus (Daday, 1914)

Comments: Reported (Sars 1901; Daday 1915: 86, 93) from Kazakhstan, Russia, Mongolia, and Himalayan India. The original description gives the distribution as “Sibiria septentrionalis”, literally: northwest Siberia. The coordinates provided (70°, 20') are for Nicandrowsk Island, in the Brekholvsky Islands (actually 70°30'N, 82°45'E) in the Yenisei River where it enters the Kara Sea in the Russian Arctic. This area is frozen some nine months of the year. This would make this the most northern spinicaudatan species. Sars (1901) stated his Kazakhstan material came from a saline lake. This species should be compared with E. consors. Daday could not reliably separate sahlbergi and propinquus. Simon (1886) and Sars (1901) separated E. sahlbergi from E. davidi using highly variable characters: carapace outline, growth line number, first antennae form, and second antennal flagellae number of antennomeres. Eocyzicus siberica was described from a single female specimen collected in Kazakhstan (Daday 1915).

Eocyzicus spinifer Durga-Prasad, Radhakrishna, Khalaf & Al-Jaafery, 1981

Comments: Known only from the type locality: Zoafarantiyah, Baghdad, Iraq. This is a very distinctive species. Rogers et al. (2017) suggests that this taxon may represent a new genus, but until a detailed examination of material is conducted, no determination can be made.

Eocyzicus tadei (Ocioszynska-Wolska, 1937)
= Caenestheria tadei Ocioszynska-Wolska, 1937

Comments: Known only from the type locality: Pokrovskoye Village, Yarkovsky District, Tyumen Oblast, Russia, north of Kazakhstan. This species should be compared with E. orientalis.

Eocyzicus taiwanensis Rogers, Chang, & Wang, 2017

Comments: Taiwan. Widespread in flooded agricultural fields in Qigu District. This species is not known from natural habitat.

Eocyzicus timmsi Tippelt & Schwentner, 2018
= Eocyzicus lineage W Schwentner et al., 2013

Comments: Queensland, Australia.

Eocyzicus ubiquus Tippelt & Schwentner, 2018
= Eocyzicus lineage U Schwentner et al., 2013
Comments: Australia: New South Wales, Queensland, Western Australia.

_Eocyzicus zugmayeri_ Daday, 1914: 228

Comments: The type locality is given as Liari, in southern Balutschistan Province, Pakistan, not too far northwest from Karachi. This species should be compared with _E. bouvieri_ and _E. orientalis_.

_Nomina dubia and species inquirendae_

_Eocyzicus afzali_ Bibi & Mahoon, 1985 _nomen dubium_ fide Rogers & Padhye, 2015

Comments: Lahore, Pakistan. The description and figures are particularly poor. The head is depicted with two very different morphologies in different figures, and the carapace appears to belong to a member of Limnadiidae, rather than the Cyzicidae (Rogers and Padhye 2015). No type material was designated.

_Eocyzicus chasuqinensis_ Han & Wang, 2004 _nomen nudum_ = _Eocycicos chasuqinensis_ Han & Wang, 2004 _nomen nudum_

Comments: From Chasuqi, Tumute Zuoqi, near Hohhot City, Inner Mongolia Autonomous Region, China. Name presented in an abstract for a conference.


Comments: Recorded once from Punjab, India. The only differential diagnosis provided by Battish (1981) is the enigmatic “From all the species... _E. dhilloni_ differs in one way or another.” Rogers and Padhye (2015) suggest that this taxon may be conspecific with _E. bouvieri_.


Comments: Apparently juveniles from a single pool in South Africa. The small size and the pitted nature of the carapace are the defining characters. However, Brehm (1958) reported that the carapaces were heavily encrusted with algae, and the pitted nature of the carapace surface may be due to the algal holdfasts.

_Eocyzicus nanchangensis_ Han & Wang, 2004 _nomen nudum_

Comments: Reported as from near Nanchang, Jiangxi Province, China. Name presented in an abstract for a conference.

_Eocyzicus swatiensis_ Chaudry, Ghauri, & Mahoon 1978 _nomen dubium_, fide Rogers & Padhye, 2015

Comments: “Pakistan”. No type material was designated and the description and figures are poor.

_Eocyzicidae Incertae sedis_

_Baikalolkhonia Naganawa, 1999 fide Galazy & Naganawa 2010 genus inquirenda_

Diagnosis: (based on Naganawa 1999; and Galazy and Naganawa 2010) Rostrum with or without an apical spine. All thoracopods bearing a pre-epipodal, cylindrical, elongated, dorsally directed lobe; epipodites without a triangular lamella; pre-epipodites elongated on limbs I–VII. Males unknown.

Comments: This is the only genus I have not examined. _Baikalolkhonia tatianae_ is the type species of the genus. Naganawa (1999 2001b) placed this genus initially in the Cyzicidae in its own subfamily, due to supposed shared characters between Cyzicidae and Leptestheriidae. Brtek (2002) raised the subfamily to family rank with no explanation or justification. This genus is remarkably superficially similar to _Eocyzicus_ and may very well be a junior synonym of that genus, although information in the descriptions is lacking. _Baikalolkhonia_ lacks the epipodal triangular lamella, as does _Eocyzicus_ and all cyzicids. The pre-epipodal cylindrical extensions are found in leptestheriids, but apparently not in the same numbers as in _Baikalolkhonia_. Both character states described for _Baikalolkhonia_ need to be verified.

The fact that two species in this genus are both endemic to Olkhon Island (some 720 km²) (Galazy and Naganawa 2010), and the fact that Naganawa (1999) states that the type series of _B. tatianae_ is immature, strongly suggest that both _Baikalolkhonia_ are the same species.

_Attributed Species_

_Baikalolkhonia tatianae_ Naganawa, 1999 _species inquirenda_

Comments: Russia; Olkhon Island, Lake Baikal.
Males are unknown, and the specimens used in the description are reported to be immature (Naganawa 1999). Types: ZMISU 960803-1.

**Baikalolkhonia shmakini** Naganawa in, Galazy & Naganawa, 2010 *species inquirenda*

Comments: Russia; Olkhon Island, Lake Baikal. Types: ZMISU 050801-1, -2. The fact that the first species described in the genus was based on juvenile material, and that both species come from the same island, suggests that this species might be a junior synonym of *B. tatiana*.

**Leptestheriidae Daday, 1913a: 44**

- Straskrabiidae Naganawa, 2001b, fide Rogers et al. 2020
- Sewellestheriidae Naganawa, 2001b

**Diagnosis:** (From Schwentner et al. 2020a) Cephalic fornice extends anteriorly to rostral apex. Rostrum variable, blunt to acute, long or short, generally triangular to subquadrate in lateral view. Rostrum with an apical spine (often broken off, look for scar). Compound eyes fused medially, sometimes projecting in smoothly arcuate ocular tubercle. Frontal organ sessile. Occipital notch present. Carapace thick, generally rounded. Carapace dorsal margin smooth, lacking carinae, hinge line straight. Carapace with or without pigmentation, growth lines obvious, projecting. Umbone present, projecting well above hinge line. Muscle scar rarely visible. Male first two thoracopods with endopod (*sensu* Olesen 2007) lacking an apical suctorial organ or modified tactile setae. Telson with or without a ventroposterior, posteriorly directed spiniform projection. Eggs 110–180 μm in diameter, spherical and generally lacking ornamentation.

Comments: The type genus is *Leptestheria* Sars, 1898a by designation (Schwentner et al. 2020a). Three genera are recognised. Sars (1898a) was particularly taken with the form of the egg bearing epipodite extensions, but both he and far more so Daday (1913a b 1914 1924), emphasised the presence of the lamina epipoditalis as the defining character of the family. Yet traditionally, regional authors have been primarily separated the Leptestheriidae from the other families based on the presence of a rostral spine. However, some eocyzicids and cyzicid species possess a rostral spine.

A list of the Leptestheriidae was provided in part by Garcia and Pereira (2003). Naganawa (2001b) created Sewellestheriidae for *Sewellestheria*, but his diagnostic characters are not exclusive, and the taxon is not accepted here.

**Eoleptestheria Daday, 1913b: 47**

- *Isaura* Joly, 1842 (pro partim), nomen praecoxcupatum
- *Estheria* Rüppell in Strauss-Durchheim, 1837 (pro partim), nomen praecoxcupatum

**Diagnosis:** Populations composed of males and females; amplexus is venter to venter. Rostrum may be sexually dimorphic. Rostrum subtriangular (usually females) to rounded (usually males). Angle between rostrum and frons 150° to 190°. Occipital notch very shallow and broad, obsolete. Occipital condyle low, rounded, length half or less basal width. Carapace valve length ~1.5–2x valve breadth (umbone to margin). Carapace growth line intervals smooth or ornamented (scarring from algae often mistaken for ornamentation). Carapace typically brown, occasionally black, sometimes with marginal setae. Clasper endopod apically with disoventral scales. Endite IV subcylindrical, bearing a dense, apical field of short spiniform setae or scales. Thoracic segments smooth or with spines or setae, sometimes borne on projections. Eggs attaching to prolonged exopods of thoracopod X and XI or XI and XII. Thoracopod exopods bearing a triangular lamina. Telson posterior margin posteriorlateral spinous rows confluent dorsally, with confluence not or slightly projecting. Each row has 30+ spines depending on species and gender. Females typically have more and smaller spines than males. Caudal filament originating between at spine row confluence to the fourth spine pair. Caudal filament base flat or borne on low mound. Cercopods arcuate. Cercopod with a dorsomedial longitudinal row of setae or spines on proximal 60–70%. Setae plumose and either long or short. Row terminates with row of 5–10 spines. Eggs smooth.

Comments: The type species is *Isaura ticinensis* Balsamo-Crivelli, 1859 by monotypy. Daday described this genus in 1913b, but still presented it as new, with an updated description in 1923. Naganawa (2001a b) treated *Eoleptestheria* as a synonym of *Leptestheria* but provided no explanation. This genus is in tremendous need of revision, and I suspect that the European and Chinese forms are distinct.

**Attributed Species**

**Eoleptestheria sangziensis** Zhang & Hu, 1992

Comments: Should be compared to the other Chinese forms. Naganawa and Orgiljanova (2000) treat all Chinese *Eoleptestheria* except this species as synonyms of *E. ticinensis*, without any mention of *E. sangziensis*.
**Eoleptestheria ticinensis** (Balsamo-Crivelli, 1859)  
= *Isaura ticinensis* Balsamo-Crivelli, 1859  
= *Leptestheria ticinensis* (Balsamo-Crivelli, 1859)  
= *Estheria ticinensis* (Balsamo-Crivelli, 1859)  
= *Eoleptestheria inopinata* Daday, 1913b: 90 nomen nudum  
= *Eoleptestheria inopinata* Daday, 1923: 261  
= *Eoleptestheria chinensis* Daday, 1923: 269, fide Brtečk, 1997  
= *Eoleptestheria variabilis* Botnariuc, 1947  
= *Eoleptestheria spinosa* Marinček, 1978  
= *Eoleptestheria spinosa tenuis* Marinček & Valvajter, 1979  
= *Eoleptestheria spinosa magna* Marinček & Valvajter, 1982  
= *Leptestheria chinensis* Daday, 1923, in Dong et al. 1982: 13  
= *Eoleptestheria spinosa mira* Marinček & Petrov, 1983  
= *Eoleptestheria dongpingensis* Hu, 1986b, fide Naganawa & Orgiljanova, 2000  
= *Eoleptestheria yanchowensis* Shu, Han & Liu, 1990, nomen nudum  

**Comments:** Australia, Czech Republic, France, Hungary, Italy, Russia, Spain, Turkey to China (Šrámek-Hušek et al. 1962; Thiéry and Pont 1987; Scanabissi Sabelli and Tommasini 1990; Timms 2009b). Possibly northern Africa: Monod (1969b) figures specimens collected from Bandiagara, Mali. Thiéry and Pont (1987) provide a redescription form French material, and Scanabissi Sabelli and Tommasini (1990) provide SEMs of material from Italy. The Chinese forms need to be re-examined and directly compared with the western forms. The record from Australia (Timms 2009b) needs to be examined more closely and is probably something different.

**Leptestheria** Sars, 1898: 9 sensu Daday, 1913b: 44  
= *Estheria* Rüppell in Strauss-Durchheim, 1837 (pro partim), nomen praeoccupatum  
= *Isaura* Joly, 1842 (pro partim), nomen praeoccupatum  
= *Leptestheriella* Daday, 1913a nomen nudum  
= *Leptestheriella* Daday, 1923: 352 (fide Brtečk, 1997)  
= *Sewellestheria* Tiwari, 1966 New Combination  
= *Brtečia* Naganawa, 2001b, fide Rogers et al., 2020  
= *Straskribia* Naganawa, 2001b, fide Rogers et al., 2020

**Diagnosis:** Populations composed of males and females; amplexus is venter to venter. Rostrum may be sexually dimorphic. Rostrum subtriangular (usually females) to rounded (usually males). Angle between rostrum and frons 150° to 190°. Occipital notch very shallow, broad. Occipital condyly low, rounded, acute or absent, length half or less basal width. Carapace valve length ~1.5–2x valve breadth (umbone to margin). Carapace growth line intervals smooth or ornamented (scarring from algae often mistaken for ornamentation). Carapace typically brown, occasionally black, sometimes with marginal setae. Clasper endopod apically with ventral scales. Endite IV subcylindrical, bearing a dense, apical field of short spiniform setae or scales. Thoracic segments smooth or with spines or setae. Eggs attaching to prolonged cylindrical exopods of thoracopod X and XI. Thoracopod exopods bearing a triangular lamina. Telson posterior margin postero-lateral spine rows confluent dorsally, with confluence not or slightly projecting. Each row has 30+ spines depending on species and gender. Females typically have more and smaller spines than males. Caudal filament originating between at spine row confluence. Caudal filament base flat or borne on low mound. Cercopods arcuate. Cercopod with a dorsomedial longitudinal row of setae or spines on proximal 60–70%. Setae plumose and either long or short. Row terminates with row of 5–10 spines. Cercopod with subapical, dorsal cirrus, extending from 2–8% of cercopod length. Eggs smooth.

**Comments:** The type species for the genus *Leptestheria* Siliqa Sars, 1898b, now regarded as a junior synonym of *L. rubidgei* (Baird, 1862). *Isaura* Joly, 1842 was used to replace *Cyzicus* (see discussion under *Cyzicus*). However, *Isaura* Joly, 1842 is a homonym of *Isaura* Savingny, 1817 (Cnidaria) (Kobayashi and Huzita 1943). *Isaura* Joly, 1842 name was inexplicably used by Alonso (1996) and Dumont and Negrea (2002) for *Leptestheria*. Brtečk (1997) reduced *Leptestheriella* to a synonym of *Leptestheria*, based on “… a series of changes between the two groups.” but provided no data and did not elaborate. Preliminary molecular analysis (unpublished) supports this combination.


Tiwari (1966) created the genus *Sewellestheria* for his *S. sambharensis*, stating that it differed from *Leptestheria* by the absence of the lamina epipoditis found in all other leptestheriids, as well as in some aspects of the telson. However, Tiwari’s (1966: 70)
figure 2f depicts a small lamina epipoditalis on the female limb I. Tiwari (1966) stated there was no justification to move this taxon to a separate family. Brtek (2002) unaccountably presented this genus in the Cyzicidae, and suggested that this genus may belong in its own family, but provided no rationale or evidence. Naganawa (2001a) presented this species in an Appendix as belonging in an “undescribed independent family”, but provided no explanation, and later (2001b) moved the genus to a new family Sewellesteriidae. The fact that the lamina epipoditalis is present in Tiwari’s own drawing, and that the remaining characters he used to define his genus are not exclusive, Sewellestheria is treated here as a junior synonym of Leptestheria.

Attributed Species

**Leptestheria aethiopica** (Daday, 1923)

_Leptestheriella aethiopica_ Daday, 1923: 376

*Comments:* Eastern Africa from Egypt and Ethiopia, to the Niger River Valley. Should be compared with _L. theilei._

**Leptestheria biswasi** Tiwari, 1965

*Comments:* Rajasthan, India. Needs to be compared with _L. jaisalmerensis_ (Rogers and Padhye 2015).

**Leptestheria brasiliensis** Van Weddingen & Rabet, 2020

*Comments:* Known only from a few pools in Palmas de Monte Alto municipality, Bahia State, Brazil.

**Leptestheria brevirostris** Barnard, 1924: 227

*Comments:* Damaraland, east of Otjiwarongo, Namibia. Figured by Brendonck (1999). Known only from the type locality Tladi.

**Leptestheria brevispina** García & Pereira, 2003

*Comments:* Venezuela.

**Leptestheria caeciliae** (Gauthier, 1951)

_Leptestheriella caeciliae_ Gauthier, 1951

*Comments:* “Station 5 – Poull Bourgou” near Tambacounda, Senegal is the only known locality. Should be closely compared with _L. laurientii_, which is known from one pool in the same vicinity. The two taxa are separated primarily on carapace ornamentation, and are probably the same species.

**Leptestheria calcarata** (Wolf, in Daday, 1923)

_Leptestheriella calcarata_ Wolf in litteris, in Daday, 1923: 366

*Comments:* Botswana, Namibia, South Africa, (Barnard 1924 1929; Brendonck 1999). Figured in Barnard (1929) and Brendonck (1999).

**Leptestheria compleximanus** (Packard, 1877)

_Leptestheria pestai_ Daday, 1923: 296, fide Maeda-Martínez et al., 2002

_Leptestheria vanhoeffeni_ Daday, 1913b, _nomen nudum_

_Leptestheria vanhoeffeni_ Daday, 1923, fide Maeda-Martínez et al., 2002

_Leptestheria vanhoeffeni_ var. _variabilis_ Daday, 1923, fide Maeda-Martínez et al., 2002

*Comments:* Northern México and the Great Plains and southern deserts of USA (Maeda-Martínez et al. 2002; Martin and Cash-Clark 1994; Rogers and Hann 2016). The type locality is Ellis, Kansas, USA. Gurney’s (1931) record of _L. vanhoeffeni_ from Paraguay is probably an error.

**Leptestheria cristata** García & Pereira, 2003

*Comments:* Venezuela.

**Leptestheria dahalacensis** (Rüppell, in Straus-Dürckheim 1837) _fide_ Daday, 1913a

_Estheria dahalacensis_ Rüppell, in Straus-Dürckheim 1837

_Isaura dahalacensis_ (Rüppell, in Straus-Dürckheim 1837)

_Estheria pesthinitions_ Brühl, 1860

_Estheria pestensis_ (in error)

_Leptestheria tenuis_ Sars, 1901

_Leptestheria dives_ Daday, 1913b: 345

_Leptestheria aegyptiaca_ Daday, 1923: 333

_Leptestheria dives_ var. _securiformis_ Botnariuc, 1947

_Leptestheria rotundirostris_ Daday, 1913: 56

_Leptestheria intermedia_ Botnariuc, 1947


_Leptestheria saetosa_ Marinček & Petrov, 1992

*Comments:* Northern México and the Great Plains and southern deserts of USA (Maeda-Martínez et al. 2002; Martin and Cash-Clark 1994; Rogers and Hann 2016). The type locality is Ellis, Kansas, USA. Gurney’s (1931) record of _L. vanhoeffeni_ from Paraguay is probably an error.
Comments: Armenia, Austria, Azerbaijan, Belgium, Croatia, Czech Republic, Egypt, Eritrea, Ethiopia, Georgia, Hungary, Iraq, Italy, Macedonia, Moldova, Mongolia, Romania, Russia (southern), Serbia, Sudan, Syria, Turkey, Ukraine (Simon 1886; Thiele 1900; Sars 1901; Daday 1913b 1923; Botnariuc 1947; Šrámek-Hušek et al. 1962; Marinček and Petrov 1985; Brendonck et al. 1989; Scanabissi Sabelli and Tommasini 1990; Miličić and Petrov 2007; Dobrynina 2010). Naganawa and Orgilijanova (2000) lumped L. xinjiangensis here, but without any explanation or evidence of material examined. Straškraba (1966) and Marinček and Petrov (1985 1991a b c) describe some of the variation in this taxon.

Leptestheria dumonti Subash Babu & Bijoy Nandan, 2010

Comments: Southern India. Padhye and Ghate (2016) provide differential diagnosis.

Leptestheria echinata (Mohammad, 1986) = Leptestheriella echinata Mohammad, 1986

Comments: Iraq, apparently only known from the type locality, east of Baghdad. Should be compared with L. iranica. Separated from that species by spinulae along the carapace and growth line margins. The type is deposited at the British Museum (1984.192).

Leptestheria gurneyi Padhye & Ghate, 2016

Comments: Rock pool species from Maharashtra, India, known only from the type locality.

Leptestheria heterochaeta Daday, 1923: 293

Comments: Algeria. Should be compared with L. mayeti.

Leptestheria inermis (Barnard, 1929: 270) = Leptestheriella inermis Barnard, 1929


Leptestheria iranica (Uéno, 1967) = Leptestheriella iranica Uéno, 1967

Comments: Iran; known only from the type locality. No types were designated, and the material examined may be lost. Should be compared with L. echinata.


Comments: Japan. Originally described from “a shallow rice field at Koya, Tomorogimura, [Kawachi Province], near the south bank of the Yodo River”, in modern day Osaka Province. Figured also in Dong et al. (1982: 12). Naganawa and Orgilijanova (2000) synonymised L. nanjingensis, but without any explanation or evidence of material examined.

Leptestheria kunmingensis Shu, Rogers, Chen, & Yang, 2015

Comments: Yunnan, China. Known only from the type locality, which has been destroyed by development.

Leptestheria laurentii (Gauthier, 1951) = Leptestheriella laurentii Gauthier, 1951

Comments: Known only from “Station 4 - Poull Koz” near Tambacounda, Senegal. Should be closely compared with L. caeciliae, which is known from only one pool in the same area. The two taxa are separated primarily on carapace ornamentation, and are probably the same species. In the original description, Gauthier (1951) gives a key to the genus for western Africa, but omits this species.


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Comments: Northern Sahara (Gauthier 1930; Algeria, Balaeric Islands, Egypt, Libya, Mauritania, Morocco, Saudi Arabia, Sudan, Tunisia, Yemen, possibly Sicily (Simon 1886; Gauthier 1929; Alonso 1996; Thiéry 1986; Roux and Thiéry 1988; Samraoui et al. 2006; Rabet et al. 2015; Van den Broeck 2015). Redescribed by Daday (1923: 288) and by Alonso (1996), who provided excellent figures. Gauthier (1938) describes some variation.

Leptestheria nobilis Sars, 1900

= Leptestheriella nobilis (Sars, 1900)
= Leptestheria hendersoni Sars, 1900, fide Simhachalam & Timms, 2012
= Leptestheriella hendersoni Sars, 1900, fide Simhachalam & Timms, 2012
= Leptestheriella gigas Karande & Inamdar, 1960, fide Simhachalam & Timms, 2012
= Leptestheriella maduraensis Nayar & Nair, 1968, fide Simhachalam & Timms, 2012
= Leptestheria maduraensis (Nayar & Nair, 1968), fide Simhachalam & Timms, 2012


Leptestheria orientalis Spandl, 1925

Comments: Known from a single collection from Borneo, near Sarawak.

Leptestheria rubidgei (Baird, 1862)

= Estheria rubidgei Baird, 1862
= Estheria macgillivrayi Baird, 1862
= Leptestheria macgillivrayi (Baird, 1862) fide Sars, 1899
= Leptestheria siliqua Sars, 1898b, fide Sars, 1899
= Leptestheria braueri Daday, 1923: 280 fide Barnard, 1929
= Leptestheria gigantea Wolf, in Daday, 1923 fide Barnard, 1929
= Leptestheria siliqua v. gigantea Wolf (in litteris), nomen nudum in Daday, 1923


Leptestheria sambharensis (Tiwari, 1966)

= Sewellestheria sambharensis Tiwari, 1966

Comments: Known only from the type locality: Sambur Lake, Rajasthan, India. Probably extinct. Brief review in Rogers and Padhye (2015).

Leptestheria sarsi (Daday, 1923) fide Padhye & Rabet, 2017

= Leptestheriella sarsi Daday, 1923: 362


Leptestheria serracauda Rogers, Dadseepai, & Sanoamuang, 2016a

Comments: Rice paddies in Roi Et Province, Thailand. Known only from the type locality and one other adjacent rice paddy.

Leptestheria setosa (Barnard, 1935)

= Leptestheriella setosa Barnard, 1935: 489

Comments: Known from four specimens from a single location in the Kalahari Desert of South Africa. It is morphologically intermediate between L. rubidgei (the form calcarata) and L. inermis, and should be compared with those two forms closely. Figured by Brendonck (1999).

Leptestheria simhadrii (Simhachalam & Timms, 2012)

= Leptestheriella simhadrii Simhachalam & Timms, 2012

Comments: Known only from the vicinity of the type locality: India, Racharla Mandal, Prakasam District, Pool at Racharla (15°28’N, 78°58’E). Despite the great variability of the material examined and overlapping characters with L. nobilis, the authors presented this taxon as new (reviewed in Rogers and Padhye 2015).

Leptestheria striatoconcha Barnard, 1924: 227


Leptestheria thielei (Daday, 1923)

= Leptestheriella thielei Daday, 1923: 370

Comments: Tanzania. Should be compared with L. aethiopica.
**Leptestheria titicacae** Harding, 1940

= *Leptestheria tucumanensis* Halloy, 1979 fide Rogers et al. (2020)

= *Straskrabia titicacae* (Harding, 1940) fide Rogers et al. (2020)

= *Brtekia tucumanensis* (Halloy, 1979) fide Rogers et al. (2020)

**Comments**: Northern Argentina, Bolivia, and Peru (Rogers et al. 2020). Brtek, in his 1997 catalogue, had the following statement after both *L. titicacae* and *L. tucumanensis*: “(the pertinence to this genus is uncertain) – probably gen. nov.” but provided no explanation as to his conclusion. Naganawa (2001b) following Brtek’s (1997) lead, made the statement that he “agrees” with Brtek, after “reconfirming” the original records, and “… the fact that at present I have enough evidence to justify in establishing…” moving these taxa to new two genera *Brtekia* and *Straskrabia*, respectively. This move was criticised in Rogers et al. (2020) and the taxonomy revised based on examination of material.

**Leptestheria venezuelica** Daday, 1923: 313

*sensu* García & Pereira, 2003

**Comments**: Aruba, Chile, Venezuela (Daday 1923; Belk et al. 2002; García and Pereira 2003; Rogers et al. 2020).

**Leptestheria villigera** Thiele, 1907

= *Lepestheriella villigera* (Thiele, 1907)

**Comments**: Madagascar. Redescribed by Daday (1923: 381).

**Nomina dubia and species inquirendae**

**Leptestheria longispinosa** Nayar, 1965

**Comments**: Juveniles, fide Tiwari (1996).

**Maghrebestheria** Thiéry, 1988

**Attributed Species**

**Maghrebestheria maroccana** Thiéry, 1988 *sensu* Alonso, 1996

= *Maghrebestheria maroçana* Thiéry, 1985 (in error?)

= *Maghrebestheria maroccana* Thiéry, 1986 in Thiéry, 1986 *nomen nudum*

**Comments**: Morocco, Spain (Thiéry 1986 1988; Alonso 1996; Van den Broeck 2015). Redescribed by Alonso (1996), who contributed excellent figures. Thiéry (1986) provided a distribution map, and listed this species under the names “*M. maroçana* Thiéry, 1985” and *M. maroccana* Thiéry, 1986b, some two years before the actual description was published. However, the only citation in that reference for “Thiéry 1985” is the original description of an anostracan, and the citation “Thiéry, 1986b” was the actual description cited as in press, although it was not published until 1988.

**Acknowledgment**: This paper is dedicated to my dear friend and collecting buddy, Brian Victor Timms. Very special thanks to Jennifer Ginsburg and my daughter Hazel L. Rogers for all their help with old Russian locality names and translations from Russian, Latin, Italian, Albanian, and French. Very special thanks to my dear friends Chun-Chieh Wang and Shusen Shu for help translating some of the Chinese texts.

**Authors’ contributions**: The author designed the
study and wrote the manuscript.

**Availability of data and materials:** Not applicable.

**Competing interests:** The author declares that he has no conflict of interests.

**Consent for publication:** Not applicable.

**Ethics approval consent to participate:** Not applicable.

**REFERENCES**


Brendonck L, Thiery A, Coomans A. 1990. Taxonomy and biogeography of the galapagos branchiopod fauna (Anostraca,
Distribution and habitat characteristics of tadpole shrimp (Crustacea: Notostraca; *Triops longicaudatus* (Le Conte)) in Korea, Korean J Limnol 43:142-149.


Perez-Bote JL. 2004. New data on the biology of Cyzicus grubei...
Zoological Studies 59:45 (2020)


Tiwari KK. 1962. New species of Conchostraca (Crustacea:
Wiltshire CT. 1973. The developmental morphology of Cyzicus morsell (Packard) (Crustacea: Conchostraca) from hatching through adulthood with comments on taxonomy within the family Cyzicidae. PhD dissertation, University of Missouri, Columbia, USA.