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Review of the Family Janiridae (Crustacea : Isopoda : Asellota)

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Contents page

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Contents (*continued*)

Abstract

The family Janiridae is reviewed, primarily using the published literature, as a step for revising the systematics of the Asellota. The history of janirid taxonomy is reviewed, and all taxa that have been attributed to the family are listed and discussed. A new composition for the family is provided with synonymies and references to all genera. The genera included in the Janiridae are: *Austrofilius* Hodgson, *Caecianiropsis* Menzies & Petit, *Caecijaera* Menzies, *Carpias* Richardson, *Ectias* Richardson, *Hawaianira* Miller, *Heterias* Richardson, *Iais* Bovallius, *Ianiropsis* Sars, *Iathrippa* Bovallius, *Jaera* Leach, *Janaira* Moreira & Pires, *Janira* Leach, *Janiralata* Menzies, *Janthura* Wolff, *Mackinia* Matsumoto, *Microjaera* Bocquet & Lévi, *Microjanira* Schiecke & Fresi, *Neojaera* Nordenstam, *Protocharon* Chappuis, Delamare-Deboutteville & Paulian. A key is provided for identification of genera belonging to the Janiridae and related families. Generic compositions are revised where necessary, and diagnoses, lists of species and most references are provided for each genus discussed. The composition of the Microparasellidae is discussed and a provisional diagnosis is given. The Microparasellidae is limited to the following genera: *Angeliera* Chappuis & Delamare, *Microcharon* Karaman, *Microparasellus* Karaman, *Paracharon* Coineau. Some genera are excluded from the Janiridae and temporarily left as family incertae sedis: *Tole* Ortmann (= *Iolella* Richardson), *Jaerella* Richardson, *Rhacura* Richardson, *Trichopleon* Beddard, *Xostylus* Menzies.

Introduction

Isopods of the superfamily Janiroidea Sars, 1897*a* (suborder Asellota) are ecologically important and biogeographically interesting. Systematic knowledge on most janiroidean families, however, is extremely limited and often superficial. The Asellota have been the subject of several major monographs and numerous smaller papers (papers prior to 1960 reviewed by Wolff 1962). In the last three decades, great interest in the Janiroidea has been generated by the discovery of its high diversity of both species and morphological types in the deep sea (Menzies 1962*a*; Wolff 1962; Birstein 1963*a*; Hessler and Sanders 1967; Hessler 1970; Hessler *et al.* 1979). This interest has resulted in the rapid accumulation of new species and genera described from deep-sea samples taken since the early 1960s. Continued sampling, especially in the tropics, has yielded a steady supply of new shallow-water taxa.

Despite this new information, few major reorganisations of the suprageneric taxa have been attempted since the monographs of Wolff (1962) and Menzies (1962*a*, 1962*b*). The family-level groups have become poorly defined as they have been forced to include a broad variety of taxa. Unusual taxa have been placed in monotypic families often because sufficient comparative information was unavailable. The family Janiridae is especially in need of revision. This family occupies a central position in the understanding of the approximately 22 families in the Janiroidea, because the deep-sea forms are probably derived from a janirid-like ancestor (Kussakin 1973, 1979*b*; Hessler *et al.* 1979). The Janiridae, however, are not the earliest-derived janiroideans (Wilson 1987). Therefore, a systematic revision of this family is urgent, because it is not possible to define the sister group of the Janiridae or to understand the origin of the 'higher Janiroidea' *sensu* Wilson (1987).

This paper reviews the genera that have been included in the Janiridae by Wolff (1962) and later authors, with the ultimate goal of revising the family's composition and definition. Unfortunately, available information cannot allow a complete revision of the family.

Although we offer suggestions for reclassifying the janirid genera and related families, more study of individual taxa is necessary before this important assemblage of shallow-water Janiroidea can be better understood. Therefore, our goal in this paper is to provide a thorough listing of the genera, species and literature for future revisions. For this reason, we have not provided illustrations of each genus. Most genera would benefit from re-illustration of their type species, but this is well beyond the scope of a single paper because so many taxa are involved. A phylogenetic analysis of janirid genera is presented in Wilson (1994) to demonstrate those difficulties that remain.

Literature Sources and Methods

A systematic review such as this would not be possible without access to a great deal of literature. Literature information prior to 1975 was obtained from Torben Wolff's taxonomic catalogue. Morphological information on janirid genera was derived from photocopy catalogues maintained separately by both authors. Literature since 1978 was checked by computerised searches of Zoological Record, BIOSIS, and Current Contents databases. Specimens from the Los Angeles County Museum and the Australian Museum were used to verify the morphology of many genera, especially *Janiralata*, *Janira*, *Iais* and *Iathrippa*. The generic diagnoses are not strictly limited to diagnostic characters, but also include the data used in the phylogenetic analysis (Wilson 1994).

The generic synonymies include only the first instance of a synonymous name, and a separate section, 'Additional References', provides additional later instances of both synonymous names as well as other generic names of species now of a particular genus. The generic synonymies and associated additional references provide most taxonomic and related references on the species of each genus, although in some cases, especially *Jaera*, not all references are included. In listings of species in each genus, we often have raised subspecies to the species rank using a phylogenetic species definition. The subspecies rank was not used unless some evidence of introgression between subspecies or other genetic information was available (*Jaera* is best known in this regard). Although this paper is taxonomic in content, we have included discussion of biology or biogeography in the Remarks section of genera where interesting topics have arisen recently.

Systematics

Superfamily **JANIROIDEA** Sars, 1897*a*

Family **JANIRIDAE** Sars, 1897*a*

Ianiridae Sars, 1897*a*: 98 (Janiridae misspelled).—Hurley, 1961: 262; Menzies, 1962*a*: 181; 1962*b*: 69; Jang and Kwon, 1990: 193–4.

Janiridae.—Ohlin, 1901: 30; Richardson, 1905*b*: 448; Stebbing, 1905: 48; Nierstrasz and Stekhoven, 1930: 116; Gurjanova, 1932: 20; 1933: 397; 1936*b*: 39; Hatch, 1947: 171; Wolff, 1962: 32, 33–40, 215, 220, 282, 283, 295, 300; Gruner, 1965: 121; Miller, 1967: 187; Schultz, 1969: 250; Kensley and Schotte, 1989: 81–82.

Parasellidae (pars) Hansen, 1905: 315–16.

Jaeridae Stebbing, 1910*b*: 224.—Monod, 1925: 238.

Ianirini Hansen, 1916: 12.—Monod, 1926: 13; Nordenstam, 1933: 172; Nierstrasz, 1941: 282; Menzies, 1951*b*: 123; Hurley, 1957: 17.

Microjaniridae Bocquet and Lévi, 1955: 117.—Birstein, 1961: 137.

History of the Janiridae

Sars (1897*a*: 98) defined the family Ianiridae for the genus *Ianira* (original spelling *Janira*) and included the genera *Ianthe* (junior synonym of *Tole*), *Ianiropsis* and *Iaera* (correctly spelled *Jaera*). Sars and later authors adopted the unfortunate tendency of exchanging 'J' with 'I' or *vice versa* in naming the genera and the family (Wolff 1965), despite their correct original spellings. Because *Janira* Leach, 1814 is the correct spelling of the type of the family, its name must be Janiridae, although the authorship still resides with Sars, 1897*a*. The period between 1886 to 1962 saw the addition of 34 genera (see list below) and many new species to the Janiridae; some like *Santia* (previously *Antias*: Sivertsen and Holthuis 1980) and *Joeropsis* (correct spelling for *Jaeropsis*: ibid.) were removed to other families before 1962. During this time, the genus *Janira* received a great burden of different forms.

Hansen (1916) subsumed all of Sars' families into the Parasellidae (a family-level *nomen nudum* because *Parasellus* is not an available name) and reduced the Janiridae to the tribe 'Ianirini'. This was followed by Nordenstam (1933), who added new family-group names such as the Jaeropsini (correctly spelled Joeropsidini: see Sivertsen and Holthuis 1980). Menzies (1956, 1962*b*) recognised the distinctness of the Janiridae, and created several new families, Janirellidae and Acanthaspidiidae, to contain genera previously classified as janirids. Taxonomists working with the interstitial isopods created new families or subfamilies to contain various dwarfish janirid-like isopods: the Microparasellidae Karaman, 1934, and the Microjanirinae Bocquet & Lévi (1955) of the family Janiridae, later elevated to family status by Birstein (1961).

The first comprehensive review of the Janiridae and these related families was Wolff (1962), where *Janira* was pared down from over 30 species to 8 species. Wolff's definition of the Janiridae (see below) included a great deal of diversity, and subsumed several wholly or primarily deep-sea families. Later workers (Menzies and Schultz 1968; Kussakin 1973; Hessler and Thistle 1975; Bowman and Abele 1982) have not used his composition of the family, although no one has provided a useful definition of the Janiridae. Miller (1967) followed Wolff's definition in adding *Hawaianira* to the family. Recently, a definition of the Janiridae even broader than Wolff's has been proposed (Kussakin 1988) that includes the Thambematidae Birstein, 1963*a* and the Acanthaspidiidae. Because of the broad definition for the Janiridae, unusual genera such as *Katianira* Hansen, 1916, *Xostylus* Menzies, 1962*a*, or *Dactylostylis* Richardson, 1911*a* are still considered part of the family or have been removed only recently (e.g. *Katianira* to the Katianiridae Svavarsson, 1987). After 1962, 18 genera either have been brought out of synonymy or were newly created. Some are junior synonyms of older taxa, and others belong in other families.

Problems in the Classification of the Janiridae

Several problems that recur in janirid systematics are evident in Wolff's (1962) diagnosis of the family, reproduced here with *italics* added to the variable parts.

'Body oblong, depressed. Head and pereonites free, with the lateral parts lamellarly expanded *in most genera* and pereonites subequal in length. Pleon *usually consists* of two segments; when present, the first is narrow and inconspicuous, the second large and shield-shaped. Eyes *often present*, situated on the upper surface. Antennae *almost always* longer than antennulae, with six joints in peduncle and with squama on joint 3 generally well developed. Mandibles with palp, and *normally with well developed molar process*. Palp of maxillipeds *usually* with joint 3 in particular, expanded; its width *almost always* equal to that of the endite or broader. First pair of pereopods *usually more or less* prehensile; the remainder are walking legs of moderate and almost equal length. Dactylus *almost always with two or three* claws. Uropods always on *the lateral or the terminal margin*, with peduncle, and *biramous or, occasionally, uniramous*.'

This diagnosis defines a generalised janiroidean or asellote isopod (e.g. Hessler *et al.* 1979) using largely plesiomorphic characters. All defined character states, with their built-in variation, can be found in most families and therefore are phylogenetically uninformative. These characters are repeatedly used to define other janiroidean families by stating any derived character states and filling out the definition from the characters above.

Our analysis of the Janiridae was obstructed by the absence of descriptions of useful characters in many species (e.g. the fourth and fifth pleopods: Menzies and Frankenburg 1968). Some taxa have been traditionally illustrated with a few limb parts to describe new species or genera, especially in the interstitial isopod literature. Such descriptions, while minimally sufficient for parochial taxonomic purposes, are nearly useless for higher-level considerations, and are difficult to use for field workers. Specialists should illustrate *all* limbs and should show the *whole organism* in several aspects. Missing from practically all illustrations of Janiridae are lateral and ventral views of various parts of the body, especially the cephalon and pleotelson.

Other, possibly useful, characters have been only recently discovered. The spermathecal duct (=cuticular organ), a female copulatory organ currently known only from the Asellota (Veuille 1978*b*; Wilson 1986*b*, 1987, 1991), is a prime example. For example, the spermathecal duct reported for Haploniscidae (Wolff 1962) differs from that in the Dendrotiidae (Lincoln and Boxshall 1983). Research on the swimming family Munnopsididae (Wilson and Hessler 1980, 1981; Wilson 1985, 1989) shows that the complex morphology of the head may also provide many useful characters. Head morphology is largely ignored in most descriptions of Asellota.

Composition of the Janiridae

The following list contains the names of all genera that have been included into the Janiridae under the broad definitions of Wolff (1962) or Kussakin (1988). Senior synonyms and taxa moved to other families are indicated in parentheses ('='indicates a senior synonym, and ':' indicates the reference establishing the synonymy or transferring the genus to another family).

Abyssijaera Menzies, 1962*a* (=*Katianira*: Katianiridae Svavarsson, 1987)
Acanthaspidia Stebbing, 1893 (Acanthaspidiidae: Menzies and Schultz 1968)
Angeliera Chappuis & Delamare-Debouteville, 1954 (Microparasellidae: Coineau 1986)
Austrofilius Hodgson, 1910
Austroniscoides Birstein, 1963*b* (=*Janthura*: Menzies and George 1972)
Bagatus Nobili, 1906 (=*Carpias*: Bowman and Morris 1979)
Caecianiropsis Menzies & Pettit, 1956
Caecijaera Menzies, 1951*a*
Carpias Richardson, 1902
Dactylostylis Richardson, 1911*a* (Janirellidae: as *Spinianirella* Menzies, 1962*a*)
Ectias Richardson, 1906
Fritzianira De Castro & Lima, 1977 (subgenus of *Heterias*: Bowman *et al.* 1987)
Hawaianira Miller, 1967
Heterias Richardson, 1904*a*
Iais Bovallius, 1886
Ianiroides Kensley, 1976 (=*Ectias*: Kensley 1978)
Ianiropsis Sars, 1897*a*
Ianisera Kensley, 1976 (=*Neojaera*: Kensley 1984*c* and herein)
Ianthopsis Beddard, 1886*b* (Acanthaspidiidae: Menzies and Schultz 1968)
Iathrippa Bovallius, 1886
Iolella Richardson, 1905b (=*Tole*, family *incertae sedis*: herein)
Jaera Leach, 1814
Jaerella Richardson, 1911*b* (family *incertae sedis*: herein)
Janaira Moreira & Pires, 1977*b*
Janatus Carvacho, 1983 (=*Carpias*: herein)
Janira Leach, 1814
Janiralata Menzies, 1951*b*
Janirella Bonnier, 1896 (Janirellidae Menzies, 1956)
Janthura Wolff, 1962
Janthurella Kussakin, 1982 (=*Katianira*: Katianiridae Svavarsson, 1987)
Jehaia Wagner, 1990 (=*Protocharon*: herein)
Katianira Hansen, 1916 (Katianiridae Svavarsson, 1987)
Mackinia Matsumoto, 1956
Microcharon Karaman, 1934 (Microparasellidae Karaman, 1934)
Microjaera Bocquet & Lévi, 1955
Microjanira Schiecke & Fresi, 1970
Microparasellus Karaman, 1933 (Microparasellidae Karaman, 1934)
Microprotus Richardson, 1909 (Munnopsididae: Wilson *et al.* 1989)
Microthambema Birstein, 1961 (Thambematidae: Harrison 1987)
Natalianira Kensley, 1984*b* (Katianiridae: Svavarsson 1987)

Neoectias Winkler, 1992 (=*Iais*: herein)
Neojaera Nordenstam, 1933
Paracharon Coineau, 1968 (Microparasellidae: Coineau 1986)
Protocharon Delamare-Deboutteville & Chappuis, 1956 (Microparasellidae: Coineau 1986)
Protojanira Barnard, 1927 (Protojaniridae: Sket 1982)
Pseudasellus Chappuis, 1951 (=*Heterias*: Williams 1968)
Pseudojanira Barnard, 1925 (Pseudojaniridae Wilson, 1987)
Rhacura Richardson, 1908 (family *incertae sedis*: herein)
Spinianirella Menzies, 1962*a* (=*Dactylostylis*: Hessler 1968)
Tole Ortmann, 1901
Thambema Stebbing, 1912 (Thambematidae: Harrison 1987)
Trichopleon Beddard, 1886*a* (family *incertae sedis*: herein)
Vermectias Sivertsen & Holthuis, 1980 (Vermectiadidae Just and Poore, 1992)
Xostylus Menzies, 1962*a* (family *incertae sedis*: herein)

Adjustments to the Composition of the Janiridae

We here limit the Janiridae to a smaller group of genera. The following paragraphs indicate the current placement of genera removed from the janirids. These adjustments are based on reasons external to the definition of the Janiridae, such as the revision of a previously included family.

Microprotus, despite its complete lack of swimming pereopods, is a derived member of the Munnopsididae *sensu lato* (Wilson 1989; Wilson *et al.* 1989). Its closest relative in the Munnopsididae seems to be *Storthyngura* Vanhöffen, 1914 (ibid.).

The genera *Abyssijaera*, *Janthurella*, *Katianira* and *Natalianira* have been removed to the new family Katianiridae by Svavarsson (1987), and are reduced to two genera. *Katianira* now contains the species of *Janthurella* and *Abyssijaera*. *Natalianira* is retained as a valid genus of the Katianiridae.

Protojanira and *Pseudojanira* have been removed from the Janiroidea. *Protojanira* is placed in its own family with the genera *Enckella* Fresi, Idato & Scipione, 1980 and *Anneckella* Chappuis & Delamare-Deboutteville, 1957. The Protojaniridae is considered to belong to either the superfamily Protojaniroidea (see Sket 1982; Wägele 1983) or the Gnathostenetroidoidea (see Wilson 1987). *Pseudojanira* was placed in its own monotypic family and superfamily (Wilson 1986*b*, 1987). Poore and Just (1990) confirm the concepts of the Pseudojaniridae and the Pseudojaniroidea with the description of abundant material of a new species, *P. investigatoris* from Bass Strait.

The family Microparasellidae Karaman, 1934, has continued to be recognised (Birstein and Ljovushkin 1965*a*, 1965*b*; Coineau 1968, 1969, 1986), despite its elimination by Wolff (1962). We discuss this family below. The genera of Microparasellidae are limited to *Microparasellus*, *Angeliera*, *Microcharon* and *Paracharon* (but see Coineau 1969, 1986).

Janirella and *Dactylostylis* (senior synonym of *Spinianirella*; see Hessler 1968) belong to the Janirellidae Menzies, 1956, following the composition of family of Menzies (1962*a*, 1962*b*). We, however, exclude the genus *Rhacura* from the Janirellidae until this genus can be reillustrated and revised. These genera have synapomorphies that clearly separate them from the Janiridae (see also outgroup discussion in Wilson 1989), so their classification in this family by Kussakin (1988) is not used here.

The family Acanthaspidiidae Menzies, 1962*a* is currently recognised (Bowman and Abele 1982; Brandt 1991). Menzies and Schultz (1968), who added several new genera to it, offered no arguments rebutting Wolff's (1962) removal of the family, although Brandt's (1991) treatment places the family on firmer ground. Therefore, we do not follow Kussakin (1988) who included *Acanthaspidia* into the Janiridae. Acanthaspidiids can be defined as janiroideans that have enlarged pereonal lappets, narrow or finger-like mandibular molars, broad maxillipedal endites with narrow palps, third pleopods with many plumose setae on both rami, and elongate uropodal sympods. Most species of this family also have dorsal spines. The family now contains *Acanthaspidia* and *Ianthopsis* (see Brandt 1991), although the latter heterogeneous taxon would benefit from a thorough revision. *Iolanthe* Beddard, 1886*a*, *Paracanthaspidia* Menzies & Schultz, 1968, and *Exacanthaspidia* Menzies & Schultz, 1968 were synonymised with *Acanthaspidia* by Brandt (1991).

The Thambematidae Stebbing, 1912, including *Thambema* and *Microthambema*, is a well-defined family (Harrison 1987). Consequently, we do not follow Kussakin (1988) in including this family into the Janiridae.

Jaerella, *Rhacura* and *Tole* (senior synonym of *Iolella*) may have characters in common but are assigned nevertheless to *incertae sedis* owing to their poor descriptions. *Trichopleon* and *Xostylus* have no place in the Janiridae: their dactylar claw form, anal position and third pleopod exopod are all characteristic of more-derived deep-sea genera. These two genera need revision before their exact affinities can be resolved, so they are temporarily assigned to *incertae sedis*.

Vermectias has been recently placed into its own family, Vermectiadidae by Just and Poore (1992), because this genus has been found to have non-janiroidean pleotelson, pleopods and penes. The male copulatory morphology of *Vermectias* might show some relationship to genera of the Microparasellidae, specifically *Angeliera* (see Just and Poore 1992).

Key to Janiroidean Genera once classified as 'Janirids'

To enter this key, a specimen must be clearly a member of the Janiroidea, based on an inspection of the first pereopod and the pleopods I–II (see diagnosis in Wilson 1994). The specimen also should lack specific apomorphies of other families. The family keys of Wolff (1962) or Kussakin (1988), which recognise a broad definition to the Janiridae, may be used first to identify many janiroidean family-level taxa, especially deep-sea taxa. All genera or families that have been placed in the 'janirid' group in the past are included in this key (see list in Introduction). This key references the following families as single entries and the component genera are not keyed out: Acanthaspidiidae, Janirellidae, Joeropsididae, Katianiridae, Munnopsididae and Thambematidae. The genera of the other 'janirid' family, the Microparasellidae, are keyed out separately. *Rhacura* Richardson, 1908 was left out of this key. The key was constructed so as to require minimal dissection, and with some recognition that incomplete specimens might be at hand. The key is polyotomous, at least at the beginning using the form of the uropod.

1a. Uropod large with normal rami, total length near that of pleotelson, uropodal endopod longer than protopod 24

1b. Uropod short, distinctly shorter than pleotelson but not squat, endopod longer than protopod 2

1c. Uropod with squat rami and sympod, rami shorter than sympod 8

1d. Uropod with thin, subequal sympod and rami; pereopods II–VII with only 1 or 2 dactylar claws 13

1e. Uropod with elongate, robust protopod that is longer than rami 19

1f. Uropods broken off but large socket present 31

2a. Frontal area with broad and quadrate rostrum ..... *Austrofilius* Hodgson, 1910 (Antarctic shallow marine)

2b. Frontal area with pointed and elongate rostrum .... *Jaerella* Richardson, 1911*b* (deep sea)

2c. Frontal area broad and/or rounded and sloping, never quadrate or pointed 3

3a. Pereopods II–VII with 3 dactylar claws or 2 dactylar claws and accessory seta; head often with a few ocelli 4

3b. Pereopods II–VII with only 1 or 2 dactylar claws; blind 5

4a. Pereopod I gnathopod, carpus enlarged with robust sensillate setae ..... *Ectias* Richardson, 1906 (free-living marine)

4b. Pereopod I leg-like, carpus slender with few setae .... *Iais* Bovallius, 1886 (free-living in fresh to brackish water to commensal on marine Sphaeromatid isopods)

5a. Pleotelson tapering posteriorly to distal spine 6

5b. Pleotelson distally rounded 7

6a. Body broad; anterior pereonites with anteriorly projecting points; antennula elongate, flagellum with around 16 articles ..... *Trichopleon* Beddard, 1886*a* (deep-sea)

6b. Body narrow; anterior pereonites laterally rounded; antennula short, flagellum with only 2 articles ..... *Microjaera* Bocquet & Lévi, 1955 (interstitial)

7a. Body extremely thin and attenuated, pereonites much longer than wide; pleopods I–II may not be opercular (pleopod III exposed) ..... Thambematidae (*Thambema* Stebbing, 1912, and *Microthambema* Birstein, 1961) (deep-sea)

7b. Body narrow, but some pereonites wider than long; pleopods I–II always opercular (pleopod III not exposed) ..... *Xostylus* Menzies, 1962*b* (deep-sea)

8a. Pereopods II–VII with 3 dactylar claws, or 2 dactylar claws and subdistal accessory seta 9

8b. Pereopods II–VII with only 1 or 2 dactylar claws, no accessory seta 10

9a. Uropodal protopod lacking medial curved spine; antenna normal; frontal area lacking rostral projection ..... *Jaera* Leach, 1814 (shallow marine to brackish and commensal with sphaeromatid isopods)

9b. Uropodal protopod with medial curved spine; antenna strongly geniculate between enlarged article 5 and article 6, proximal flagellar articles conjoint and swollen; frontal area with separate rostral projection ..... Joeropsididae (*Joeropsis* Koehler, 1885) (shallow marine, cosmopolitan)

10a. Uropods uniramous ..... *Microparasellus* Karaman, 1933 (interstitial, fresh water)

10b. Uropods biramous 11

11a. Pereopods II–VII with ventral dactylar claw subequal to dorsal claw; antennal flagellum proximal articles wider than long, conjoint, near width of article 6 ..... *Hawaianira* Miller, 1967 (shallow marine)

11b. Pereopods II–VII with ventral dactylar claw distinctly smaller than dorsal claw; antennal flagellum proximal articles separate, not conjoint, longer than wide 12

12a. Antennal articles 5–6 near length of articles 1–4; maxillipedal palp wider than endite ..... *Caecijaera* Menzies, 1951*a* (commensal with limnoriid isopods)

12b. Antennal articles 5–6 distinctly longer than articles 1–4; maxillipedal palp distinctly narrower than endite ..... *Neojaera* Nordenstam, 1933 (shallow marine)

13a. Body with dorsal and/or lateral denticles or spines 14

13b. Body without denticles or spines 15

14a. Uropods biramous; pereonites 5–7 and pleotelson fused together ..... Munnopsididae, in part (*Microprotus* Richardson, 1909) (deep sea, blind)

14b. Uropods short and uniramous; pereonites 5–7 and pleotelson free ..... Janirellidae (*Janirella* Bonnier, 1896) (deep sea, blind))

15a. Maxillipedal palp narrower than endite, articles subequal; antenna articles 5–6 length subequal to articles 2–3 ..... *Protocharon* Delamare-Deboutteville & Chappuis, 1956 (fresh water on islands)

15b. Maxillipedal palp wider than or subequal to endite, articles subequal; antenna articles 5–6 distinctly longer than articles 2–3 16

16a. Frontal area broad, rounded, projecting between antennulae ..... *Microjanira* Schiecke & Fresi, 1970 (shallow marine)

16b. Frontal area narrow, antennulae not widely separated 17

17a. Male pleopod II stylet shorter than protopod, thin, with distinct angle in distal part ..... *Mackinia* Matsumoto, 1956 (subterranean fresh water)

17b. Male pleopod II stylet much longer than protopod, distally coiled 18

18a. Antennal scale absent; some pereopodal coxae visible in dorsal view ..... *Heterias* (*Fritzianira*) De Castro & Lima, 1977 (South American fresh water)

18b. Antennal scale present; no pereopodal coxae visible in dorsal view ..... *Heterias* (*Heterias*) Richardson, 1904*a* (Australian and Tasmanian fresh water)

19a. Uropods without rami, made of single segment; pereopod I chelate with large seta forming fixed finger on propodus ..... Katianiridae (*Katianira* Hansen, 1916, and *Natalianira* Kensley, 1984*c*) (deep sea, blind)

19b. Uropods with at least one ramus or biarticulate; pereopod I leg-like or subchelate 20

20a. Body thin, worm-like; head longer than broad; pereopods inserting dorsolaterally 21

20b. Body broad, often with dorsal or lateral spines; head broader than long; pereopods inserting ventrally 23

21a. Antennal scale absent; maxillipedal palp thin, much narrower than endite, with only 4 articles, distal article pointed; pereopods II–VII with 3 dactylar claws ..... *Angeliera* Chappuis & Delamare-Deboutteville, 1954 (interstitial marine)

21b. Antennal scale present; maxillipedal palp with 5 articles; pereopods II–VII with only 2 dactylar claws 22

22a. Pereopodal coxae visible in dorsal view ..... *Microcharon* Karaman, 1934 (interstitial marine to fresh water)

22b. Pereopodal coxae not visible in dorsal view, hidden by small tergal plate ..... *Paracharon* Coineau, 1968 (interstitial freshwater, tropical islands)

23a. Maxillipedal endite much broader than palp; pleopod III exopod broad with multiple plumose setae ..... Acanthaspidiidae [*Acanthaspidia* Stebbing, 1893 (blind) and *Ianthopsis* Beddard, 1886*b*] (shallow marine to deep sea)

23b. Maxillipedal width near that of palp; pleopod III exopod narrow without plumose setae ..... *Tole* Ortmann, 1901 (senior synonym of *Iolella*) (Arctic marine)

24a. Uropodal exopod minute or absent ..... *Caecianiropsis* Menzies & Pettit, 1956 (excluding *C. ectiformis*) (shallow marine interstitial)

24b. Uropodal exopod near length of protopod, not minute or absent 25

25a. Pereopods II–VII with only 1 large dactylar claw, second claw seta-like, third claw absent ..... *Janthura* Wolff, 1962 (deep-sea, blind)

25b. Pereopods II–VII with 3 dactylar claws or 2 dactylar claws and subdistal accessory seta 26

26a. Body vermiform; pleotelson tiny, much smaller than pereonites; 3 anterior pleonites free ventrally ..... Vermectiadidae (*Vermectias* Sivertsen & Holthuis, 1980) (shallow marine, subantarctic)

26b. Body normal; pleotelson longer than pereonites; no more than 2 anterior pleonites visible ventrally 27

27a. Pereopod I propodus with proximoventral denticles; pereonites often with large lateral lappets or spines ..... *Janiralata* Menzies, 1951*b* (shallow marine to deep sea)

27b. Pereopod I propodus lacking distinct proximoventral denticles; pereonites without spines and with only small lappets 28

28a. Male pereopod I propodus and carpus enlarged, often swollen ..... *Carpias* Richardson, 1902 (tropical shallow marine)

28b. Male pereopod I carpus elongate, not swollen; male propodus never enlarged, always slender ..... *Ianiropsis* Sars, 1897*b* (shallow marine)

28c. Male pereopod I carpus and propodus not elongate, near length of pereopods II–VII ... 29

29a. Head with small dorsally curved rostrum; eyes large, often bulging laterally; uropodal rami flattened ..... *Iathrippa* Bovallius, 1886 (southern hemisphere shallow marine)

29b. Head generally lacking small rostrum; eyes compact, set on head without bulging distinctly laterally; uropodal rami round in cross-section 30

30a. Male pleopod I without protruding lateral lobes; maxillipedal endite much narrower than broad palp ..... *Janaira* Moreira & Pires, 1977*b* (Brazilian shallow marine)

30b. Male pleopod I with distinct lateral lobes separate from medial lobes; maxillipedal endite width subequal to palp ..... *Janira* Leach, 1814 (shallow marine)

31a. Pereopods II–VII with 3 dactylar claws or 2 dactylar claws and subdistal accessory seta 32

31b. Pereopods II–VII with only 1 or 2 dactylar claws, no accessory seta 33

32a. Maxillipedal endite width near that of palp; pleopod III exopod narrow without plumose setae 27

32b. Maxillipedal endite much broader than palp; pleopod III exopod broad with multiple plumose setae ..... Acanthaspidiidae (see 23a)

33a. Pereopod I chelate with large seta forming fixed finger on propodus ..... Katianiridae (see 19a)

33b. Pereopod I leg-like, not chelate 34

34a. Body narrow, worm-like ..... *Caecianiropsis* Menzies & Pettit, 1956 (interstitial marine)

34b. Body broad, often with spines 35

35a. Pereonites 5–7 and pleotelson fused together ..... Munnopsididae, in part (*Microprotus* Richardson, 1909) (deep sea, blind)

35b. Pereonites 5–7 and pleotelson free 36

36a. Head without anteriorly projecting rostrum ..... *Janthura* Wolff, 1962 (deep sea, blind)

36b. Head with anteriorly projecting rostrum 23

Genera of the Janiridae

Austrofilius Hodgson, 1910

Austrofilius Hodgson, 1910: 51.

Type species: *Austrofilius furcatus* Hodgson, 1910.

Species Included

A. furcatus Hodgson, 1910: 51; *A. serratus* Vanhöffen, 1914: 554. (Not included: *A. arnaudi* Kussakin & Vasina, 1980; '*Austrofilius furcatus*' Branch, Griffiths, Kensley & Sieg, 1991.)

Other References

Austrofilius.—Vanhöffen, 1914: 554; Nordenstam, 1933: 252; Barnard, 1940: 434; Schultz, 1976: 24, 27; Kussakin and Vasina, 1980: 362; 1984:12; Kussakin, 1982: 82.

Neojaera.—Menzies, 1962*b*: 74; Wolff, 1962: 252, 254, 259, 290; Amar and Roman, 1973: 571; Siebenaller and Hessler, 1977: 20; Kensley, 1978: 139.

Diagnosis

Body broad and flattened. Cephalon with broad quadrate rostrum and dorsal eyes; lateral margins concave, sometimes with denticles and pointed anteriorly. Lateral margins of pereonites smoothly concave, coxae not visible in dorsal view. Pleotelson shield-like, with rounded lateral margins and generally with lateral denticles. Antennula short, with only 5–6 articles; first article broad, flagellum with 2–3 articles. Antenna with conspicuous scale (exopod); proximal articles of the flagellum conjoint and swollen. Mandibular molar process truncate with broad grinding surface, palp with 3 articles. Maxillipedal palp articles 2–3 expanded, distinctly broader than articles 4–5 and endite. Pereopod I ambulatory, dactylus short, with 2 claws; propodus and carpus with row of setae on ventral margin. Pereopods II–VII dactyli with two distal claws, ventral claw smaller than dorsal claw. Male pleopod I lateral lobes curving, projecting posteriorly, medial lobes broad and rounded, also distinctly projecting; proximal region narrow with straight or concave lateral margins. Sympod of male pleopod II acutely pointed or rounded, setiferous; endopod curved, sometimes elongate and coiled, much longer than sympod, with proximal article sometimes enlarged. Female operculum broad ovate, distally rounded. Pleopod III endopod with 3 plumose setae having distinct gap between medial seta and two lateral setae; exopod narrower and longer than endopod; exopod with 2 segments, lacking distal plumose setae. Uropods biramous, branches of subsimilar length; sympod squat, distinctly shorter than rami.

Remarks

Austrofilius has had a varied history since it was first described by Hodgson (1910). The genus was recognised by authors who studied Antarctic isopods, including Nordenstam (1933), until recently. Menzies (1962*b*), however, dubiously created a synonymy with *Neojaera*, and later authors followed this opinion (Wolff 1962; Siebenaller and Hessler 1977). Schultz (1976) reinstated *Austrofilius*, addressing the broad rostrum that *Neojaera* species lack. Kussakin (1982) and Kussakin and Vasina (1980) recognised *Austrofilius*, but the former paper included a new species of *Austrofilius* that lacks a rostrum and thus belongs in *Neojaera*. The enlarged endopodal proximal article of male pleopod II with the elongate coiled stylet, characteristic of *Neojaera*, is also found in *A. serratus* but not in the type species, *A. furcatus*. The pleopods I–II of the males in both species indicates that they are related (similar form, distribution of setae on protopod of pleopod II). On the other hand, a fully mature male of *A. furcatus* may not have been illustrated to date. This feature is left variable in the diagnosis for this reason.

The diminutive, *Iais*-like *Austrofilius arnaudi* Kussakin & Vasina, 1980 departs rather substantially from *A. furcatus*. The cephalon and pereonites do not extend laterally into broad plates, the pereopodal coxae are visible in dorsal view, and the rostral area of the head is rounded rather than quadrate. *A. arnaudi*, however, is not a member of *Iais*, owing to its broad rostral area and the biunguiculate pereopods. The body form is reminiscent of

Protocharon, but the rostrum and normal shape of the maxilliped prevents this species from being placed here. For the moment, the species *arnaudi* must be classified as janirid genus *incertae sedis*. The species '*Austrofilius furcatus*' Branch, Griffiths, Kensley & Sieg, 1991 (not Hodgson, 1910) appears to be similar to *arnaudi* and also should be excluded from *Austrofilius*.

Caecianiropsis Menzies & Pettit, 1956

Caecianiropsis Menzies and Pettit, 1956: 442.

Species Included

C. psammophila Menzies & Pettit, 1956: 442; ?*Austroniscus ectiformis* Vanhöffen, 1914: 553; *C. birsteini* Kussakin, 1979*a*: 107.

Other References

Austroniscus.—Branch *et al.*, 1991: 28.

Caecianiropsis.—Birstein, 1961: 137; Wolff, 1962: 36, 38, 236, 276, 251, 291; Kussakin, 1967: 339 (English translation 1968: 341); Schultz, 1969: 256–7; Kensley, 1976: 295; Coineau, 1986: 468; Kussakin, 1988: 160.

Diagnosis (based primarily on *C. psammophila*)

Body elongate and thin, more than 5× longer than wide. Cephalon anterior margin with rounded, nonprojecting rostrum; eyes absent; lateral margins of head rounded, never denticulate, lacking anterior points. Pereonites laterally rounded lacking lappets, coxae visible in dorsal view. Pleonite 1 near width of pereonite 7. Pleotelson oval, posteriorly rounded, approximately same width as pereonites, lateral margin with tiny denticles anterior to insertion of uropods. Antennula first article longer than broad, flagellum with 2–3 articles. Antenna article 3 distinctly longer than articles 1, 2, and 4, with tiny rudimentary scale; flagellum with 15 or more distinct articles, each longer than wide, proximal articles not conjoint; articles 5–6 distinctly longer than basal articles. Mandibular molar process truncate but tapering distally; palp functional with large setose distal article. Maxillipedal endite longer than broad; palp articles 2–3 expanded, broader than endite; palp articles 4–5 distinctly narrower than proximal articles. Pereopod I resembling ambulatory legs, carpus elongate, dactylus short with 2 claws; propodus and carpus with few spine-like setae. Pereopods II–VII dactyli with two distal claws, ventral claw near same size as dorsal claw. Male pleopod I medial lobes distally rounded; lateral lobes angular, projecting laterally. Male pleopod II with exopod inserting subdistally on sympod; endopod with long coiled slender stylet and expanded proximal article; protopod narrow, more than 2·5× longer than wide. Pleopod III endopod with 3 plumose setae having distinct gap between medial seta and two lateral setae; endopod broader than and around same length as exopod; exopod, with 2 segments, lacking plumose setae. Uropods elongate, biramous; protopod distinctly longer than wide, shorter than endopod; exopod inserting apically, shorter than endopod.

Remarks

Caecianiropsis is a marine interstitial genus with 3 known species. The genus has an apparent bipolar distribution with two morphologically distinct groups. The northern group, containing *C. psammophila* from Northern California (Menzies and Pettit 1956) and *C. birsteini* from the Bering and Okhotsk Seas (Kussakin 1979*a*), has elongate antennal flagellae, a rostrum only slightly wider than the basal antennular article, and a pleotelson that is broadest just anterior to the uropods. The southern group includes only *C. ectiformis* from Kerguelen (Kussakin 1974) and St Paul Islands (Kensley 1976) in the South Indian Ocean and possibly from Marion and Prince Edward Islands in the South Atlantic (Branch *et al.* 1991). This species has a compact antennular flagellum, its rostrum is much broader than antennular article 1, and its pleotelson either narrows posteriorly or is at least parallel-sided laterally. The male pleopods are poorly known in *C. ectiformis*, although the pleopod I differs from that of the northern group in lacking the angular lateral extensions. Menzies and Pettit (1956) uncertainly assigned *C. ectiformis* to this genus, and Kensley (1976)

maintained this classification. Kensley in a recent paper (Branch *et al.* 1991) erroneously placed the species in *Austroniscus*, Vanhöffen's (1914) original placement. *C. ectiformis* may not belong in this genus owing to the differences between the northern and southern groups, but a redescription is necessary to demonstrate this. In *C. psammophila*, the male second pleopods are similar to those seen in *Neojaera*, especially the elongate coiled stylet. This would argue for a close relationship between the two genera, although the generality of this observation is unknown.

Caecijaera Menzies, 1951*a*

Caecijaera Menzies, 1951*a*: 3.

Type species: *Caecijaera horvathi* Menzies, 1951*a*.

Species Included

Caecijaera horvathi Menzies, 1951*a*: 3; *C. mirabilis* Kussakin, 1962: 53; *C. borealis* Kussakin, 1962: 59; *C. derjugini* Kussakin, 1962: 56.

Other References

Caecijaera.—Menzies, 1962*b*: 70; Wolff, 1962: 39, 236, 251, 254, 276, 281, 291; Kussakin, 1988: 168; Schultz, 1969: 257; Cooke, 1977: 105; Svavarsson, 1982: 224.

Diagnosis

Body broad, setose, lateral margins broadening posteriorly. Cephalon broad, lateral margin rounded or linear, with rounded or pointed anterior projection; eyes lacking; rostrum absent, vertex projecting anteriorly. Tergites of pereonites 2–4 with single anterolateral lappets, posterolaterally concave; pereopodal coxae visible in dorsal view on pereonites 1–4; coxae on pereonites 5–7 not visible in dorsal view. Pleonite 1 short, much narrower than pereonites or pleotelson. Pleotelson as broad or broader than pereonite 7; lateral margins setose without denticles. Antennula article 1 wider than long, with distinct setose medial lobe; flagellum with 2–3 articles. Antenna basal articles 1–4 length subequal; article 3 with large setose scale; articles 5 and 6 short and stout, near length of article 3; flagellum with 8–11 articles, each separate and longer than wide, but not basally conjoint. Mandible thin, elongate with reduced and tapering molar process (broader in subgenus *Caecijaerella*); palp distal article with few setae, not strongly curved. Maxilliped endite longer than wide; palp broader than endite with distal 2 articles distinctly narrower than basal articles. Pereopod I similar to walking legs; propodus narrower than carpus with no ventral setae; carpus subrectangular with few ventral setae. Pereopods II–VII dactylus with only 2 distal claws, with ventral claw tiny, much smaller than dorsal claw. Male pleopod I distal tip lacking large laterally projecting lobes. Male pleopod II proximal article of endopod near maximum width of stylet or somewhat thicker than stylet; stylet varying from shorter than protopod (*C. horvathi*) to longer than sympod with distal part elongate and curving but not distally coiled. Pleopod III endopod with many plumose setae, sometimes with gap between medial seta and lateral setae; exopod with 2 free articles, lacking plumose setae, narrower but longer than broad endopod. Uropods with squat rami and sympod; exopod apical; sympod longer than rami with distinct setose lateral lobe.

Remarks

Caecijaera has a body form reminiscent of *Heterias* and *Jaera* because it broadens posteriorly to a broad and rounded pleotelson; this form is best expressed in the three boreal species described by Kussakin (1962) in his subgenus *Caecijaerella*: *C. mirabilis*, *C. borealis*, and *C. derjugini*. *Caecijaera* apomorphies include a broad antennular article 1 with a distinctive medial lobe, short and squat antennae with a large scale, and many plumose setae on the broad pleopod III endopod. An elongate male pleopodal stylet forming only a single coil seems to be a synapomorphy of subgenus *Caecijaerella*, while the stylet of *C. Caecijaera horvathi* is more normal, being shorter than the protopod. The molar process also varies

considerably among the four species: from more or less normal in *C. borealis* to greatly reduced in the type species, *C. horvathi*. The entire mandible is rather attenuated in this latter species. *Caecijaera* species are small commensals of the isopod wood-borer, *Limnoria*: they live in *Limnoria*'s burrows and may feed on the fungi and bacteria living on the burrow walls (Svavarsson 1982; Bowman 1988). *C. horvathi* described from Hawaii (Cooke 1977) may be a distinct species because its male pleopods have distinctly elongate lateral lobes, while the individuals described by Menzies (1951*a*) have lateral lobes that only slightly exceed the length of the medial lobes.

Carpias Richardson, 1902

Carpias Richardson, 1902: 294.—Bowman and Morris, 1979: 650.
Bagatus Nobili, 1906: 268.—Nobili, 1907: 42; Pires, 1980: 96.
Janatus Carvacho, 1983: 289.

Type species: *C. bermudensis* Richardson, 1902.

Species Included

Carpias bermudensis Richardson, 1902: 294; *C. floridensis* Menzies & Kruczynski, 1983: 92; *C. harrietae* Pires, 1981*a*: 206; *Bagatus stylodactylus* Nobili, 1906; *Janira algicola* Miller, 1941: 317; *B. brachydactylus* Pires, 1982: 239; *B. brucei* Monod, 1974: 1123; *Janira crosslandi* Stebbing, 1910*a*: 108; *B. galloprovincialis* Amar, 1950: 36; *B. ichthyoxenos* Monod, 1961: 68; *B. longidactylus* Nordenstam, 1946: 14; *B. longimanus* Pillai, 1954: 19; *Janira minuta* Richardson, 1902: 297; *Janira? nanus* Stebbing, 1905: 50; *B. nereus* Pires, 1982: 254; *Janiropsis parva* Omer-Cooper, 1921: 1; *B. punctatus* Kensley, 1984*a*: 61; *B. serricaudus* Menzies & Glynn, 1968: 78; *B. stebbingi* Monod, 1933: 169; *B. triton* Pires, 1982: 251; *Janatus villalobosi* Carvacho, 1983: 289.

Other References

Carpias.—Richardson, 1905*b*: 452; Omer-Cooper, 1921: 79; Nierstrasz, 1941: 287; Menzies, 1962*b*: 70; Wolff, 1962: 39, 236, 276, 281, 290; Miller, 1968: 23; Schultz, 1969: 260; Pires, 1980: 97; Menzies and Kruczynski, 1983: 92; Kensley and Snelgrove, 1987: 196; Kensley, 1988: 41; Kensley and Schotte, 1989: 82; Schotte *et al.*, 1991: 253; Müller, 1992: 331, 337.

Bagatus.—Nierstrasz, 1941: 284; Amar, 1952: 355; Wolff, 1962: 39, 235, 276, 281, 292, 300; Fresi, 1968: 271; Bellan-Santini, 1969: 30; Geldiay and Kocatas, 1972: 26; Pires, 1981*b*: 32; Ortiz, 1983: 9; Kensley, 1984*b*: 33; Müller, 1989: 203–7; Müller, 1992: 331–2.

Janira?.—Vanhöffen, 1914: 528; Brian and Dartevelle, 1949: 93.

Janira.—Richardson, 1905*b*: 471; Vanhöffen, 1914: 528; Monod, 1931*c*: 408; Nierstrasz, 1941: 283; Nordenstam, 1946: 15; Barnard, 1962: 244; Kensley, 1978: 139; Menzies and Glynn, 1968: 79; Schultz, 1969: 258.

Diagnosis

Body moderately broad, pereonite 4 broadest, tergites of pereonites 2–4 laterally concave; coxae visible in dorsal view on most pereonites. Cephalon broad, laterally rounded, with dorsolateral eyes, vertex straight or concave, lacking rostrum. Pleotelson broad, laterally rounded, lacking denticles on posterolateral margins. Pleonite 1 free, short, distinctly narrower than pleotelson or pereonite 7. Pleotelson same width as posterior pereonites; lateral margins of pleotelson lacking denticles. Antennula basal article only slightly broader than second article, length decidedly greater than width; flagellum multiarticulate, approximately 7–11 articles in males. Antenna articles 1–4 subequal with large scale on article 3; antennal articles 5 and 6 longer than basal articles 1–4; flagellum multiarticulate, with more than 20 articles, proximal articles of flagellum not conjoint, separate and longer than wide. Mandibles normal with truncate, nontapering molar process; palp elongate, distal article curved and setose. Maxillipedal endite longer than wide; palp broader than endite, distal articles 4–5 thin, straight-sided, much narrower than broad palp articles 1–3. In female,

pereopod I carpus enlarged, oval, with two rows of spine-like sensory setae. In male, pereopod I enlarged, without large spine-like setae on carpus, but with strong spines on subchelate margin of carpus; carpus subchelate (distoventral) margin variously inflated or rounded; propodus elongate, curved, often distally inflated. Pereopod II of male generally similar to pereopods III–VII. Pereopods II–VII dactylus with 2 large subequal distal claws on dactylus with third large subdistal accessory claw. Male pleopod I distal tip 'V' shaped, with merging medial and lateral lobes; lateral lobes projecting posteriorly. Male pleopod II stylet never coiled, often near length of sympod, proximally; basal article of endopod not enlarged, only slightly wider than proximal part of basis. Pleopod III endopod either with 3 plumose setae, either equally spaced or with gap between medial seta and 2 lateral setae; exopod of both sexes narrower than endopod and same length as or longer than endopod; exopod uniarticulate, distally rounded, lacking plumose setae. Uropods large, near length of pleotelson or longer, with narrow elongate rami and sympod; exopod apical; sympod shorter than rami.

Remarks

Carpias Richardson is a common tropical and subtropical genus. Specimens of this genus are often encountered in shallow (less than 10 m) marine habitats around coral reefs. *Carpias* belongs to the shallow-water group of three-clawed janirids that includes *Ianiropsis*, *Janaira* and *Janira*. Species of *Carpias* and its junior synonym *Bagatus* display similar sexual dimorphism in pereopod I: the male has an enlarged and carpochelate pereopod I, with *Carpias* perhaps being more extreme than *Bagatus*. *Bagatus* was synonymised into *Carpias* Richardson by Bowman and Morris (1979), but Pires (1980) recognised and maintained their distinctness. The genus *Carpias* Richardson, 1902, was also synonymised (incorrectly) by Menzies and Glynn (1968) into *Bagatus* Nobili, 1906.

According to Pires (1980), *Bagatus* and *Carpias* are without doubt closely related, but are not identical. She gives the following 'key characters' of *Carpias* (*ibid.*, p. 96).

'Pereonite I nearly 1·5 times wider than head. Pereopod I: ischium and merus long, subequal in length; basal third of carpus narrow, the remaining portion very enlarged with lateral outer margin globularly swollen; propodus narrow, with the apex roundish but never dilated.'

In the discussion, she also pointed out that 'the copulatory organ of pleopod II does not reach the distal margin of the sympod ...' In her concept, *Bagatus* is similar but has long copulatory organs on pleopod II, the pereopod I carpus is never swollen, the pereopod I ischium and merus are short, and pereonite 1 is subequal to the width of the head. Significantly, Pires (1980) does not include any of these key characters in the diagnosis for *Carpias*, except for the shape of the distal articles of the male pereopod I. Pires (1981*a*) added a species, *Carpias harrietae*, that conflicts with her key features for the genus, except for the swollen carpus of pereopod I. The stylet of the male pleopod II of *C. harrietae* is long and coiled, although Pires rationalises its length by the statement that it does not extend beyond the distal margin of the sympod (Pires 1981*a*). Elongate stylets, however, are typically coiled in most janirids. The length of the stylet should be measured on the medial margin from its proximal articulation with the first endopodal article to the distal tip (as done in Wilson and Hessler 1980). The definition of *Carpias* was not adjusted in Pires (1980) to take account of the similarities of *C. harrietae* to species of *Bagatus*. A third species, *C. floridensis* Menzies & Kruczynski (1983), is also near the definition of *Bagatus* given by Pires (1982) except that the male first pereopod I has a swollen carpus and propodus.

Therefore, the only significant character in Pires' (1982) concept that separates the two genera is the form of the male pereopod I carpus. Because this character is within the possible structural variation of these two genera (e.g. see Pires 1982: *B. stylodactylus* and *B. platydactylus*, her figs 43 and 45 from Nobili 1907), *Carpias* as defined by Pires (1980) does not appear to be a monophyletic group. Notably, the published illustrations of the distal tip of male pleopod I for species of *Carpias* are more similar to species of *Bagatus* than they are to each other.

More recently, Müller (1992) claimed that the two genera can be distinguished by the presence of one or more large teeth on the proximal ventral margin of the mature male propodus. Using this feature, he proposes the transfer of the species *punctatus*, *brachydactylus*, *brucei* and *minutus* from *Bagatus* to *Carpias*. The presence or absence of denticles on the male propodus I is not a convincing character because Pires (1982, her figs 7, 8) clearly shows that males of *minutus* change from a *Bagatus* form to a *Carpias* form during maturation. Moreover, the male pereopod of *minutus* is little different from other species in *Bagatus* sensu Pires (1982). Because the two genera cannot be clearly defined, the synonymy of *Carpias* and *Bagatus* is retained, with the senior synonym being *Carpias* Richardson (see Bowman and Morris 1979).

Carvacho (1983) created a new genus, *Janatus*, for the species *villalobosi*, because this species seemed intermediate between *Janira* and *Bagatus*. *Janatus* was erroneously justified further by its intermediate geographic position between *Janira* and *Bagatus*. *Janatus* is well within the known morphological variation of *Carpias* (especially in the male pleopod I: see Pires 1980, 1981*a*, 1982), and it has an enlarged male pereopod I, an autapomorphy of *Carpias*. Therefore, *Janatus* is a junior synonym of *Carpias*. *C. villalobosi* (Carvacho 1983) may belong to the *minutus* group of Pires (1982). *C. galloprovincialis* (Amar 1950) is recognised as a full species rather than a subspecies of *C. stebbingi* (Monod).

Ectias Richardson, 1906

Ectias Richardson, 1906: 14.
Ianiroides Kensley, 1976: 295 (created for *Janira angusta*).

Type species: *Ectias turqueti* Richardson, 1906.

Species Included

Ectias turqueti Richardson, 1906: 14; *Janira angusta* Barnard, 1920: 404.

Other References

Ectias.—Richardson, 1913: 18; Tattersall, 1921: 202; Nordenstam, 1933: 186; Hale, 1937: 31; Nierstrasz, 1941: 288; Stephensen, 1947: 8; Wolff, 1962: 36, 38, 39, 236, 276, 252, 289, 291; Kussakin, 1967: 339; 1968: 341; Arnaud, 1974: 646; Schultz, 1976: 30; Kensley, 1978: 135; Kussakin, 1982: 82.

Diagnosis

Body narrow, with all pereonites approximately same width; length approximately 6× width. Cephalon lateral margin rounded, with no spines; vertex convex or obtusely angular but lacking rostrum; small eyes on dorsal surface near lateral margin. Tergites of pereonites laterally rounded, with coxae visible only as narrow crescents on anterior edges of pereonites 1–4 and posterior edges of pereonites 5–7. Pleonite 1 short, distinctly narrower than pleotelson or pereonite 7. Lateral margins of pleotelson rounded, lacking any denticles. Antennula short but longer than cephalon, antennular article 1 straight-sided, length decidedly greater than width; flagellum with 5–6 articles. Antennal basal articles (1–4) all same length with distinct scale on article 3; articles 5 and 6 elongate, much longer than basal articles 1–4; flagellum multiarticulate, numbering 15 or more articles; subproximal flagellar articles separate, wider than long but not conjoint and not wider than antennal article 6; most proximal flagellar article longer than wide. Mandibular molar process truncate but distally tapering; palp elongate with curved and setose distal tip. Maxillipedal endite longer than wide; only slightly narrower than palp; palp distal articles 4–5 narrow and straight-sided, narrower than broad basal palp articles 1–3. Pereopod I carpus subchelate, enlarged and subtriangular, with 2 rows of few spine-like setae on margin opposing propodus; propodus with no spine-like setae. Pereopod II–VII dactylus with ventral claw near same size as dorsal claw, and accessory seta enlarged into third claw. Male pleopod I narrow, distally 'V'-shaped, with medial and lateral lobes merged into elongate posterolateral projections. Male pleopod II proximal article of endopod enlarged, decidedly rounded, and

thicker than stylet; stylet much longer than sympod; elongate and curving, but not distally thin and tightly coiled. Pleopod III endopod with 3 plumose setae, with distinct gap between medial seta and outer 2 setae; exopod more slender but longer than endopod, with many plumose setae, with 2 free articles with interior suture strongly slanting to body axis. Uropods reduced, distinctly shorter than pleotelson; endopod flattened with rounded margins; exopod inserting apically; sympod subrectangular, shorter than rami.

Remarks

Kensley (1976) erected the genus *Ianiroides* for *Janira angusta* Barnard, 1920, but later placed this species in *Ectias* (Kensley 1978). Apomorphies of *Ectias* include a carpo-subchelate pereopod I with an enlarged carpus, elongate and widely separated lateral lobes on the male pleopod, a long curling stylet on the male pleopod II (but not distally coiling), and plumose setae on the exopod tip of pleopod III.

Hawaianira Miller, 1967

Hawaianira Miller, 1967: 187.

Type species: *Hawaianira peleae* Miller, 1967.

Species Included

Hawaianira peleae Miller, 1967: 187; *Janira caudata* Richardson, 1910: 33.

Other References

Ianthopsis.—Wolff, 1962: 41, 254.
Janira.—Nierstrasz, 1941: 282.

Diagnosis

Body compact, flattened, pereonite widths subequal. Cephalon broad, lateral margins with acute anterior projections, lacking denticles; vertex lacking rostrum, slightly convex; eyes dorsal. Pereonites laterally truncate, without notches or lappets, coxae not visible in dorsal view. Pleonite 1 fused to pleotelson. Pleotelson shield-like, same width as anterior pereonites; lateral margins indented at posterolateral insertions of uropods, with small posterolateral denticles. Antennular article 1 enlarged, width near length or wider, with distinct medial lobe; flagellum with 3 articles. Antenna long; basal articles (1–4) subequal length, with small scale on article 3; articles 5 and 6 much longer than basal articles 1–4; flagellum with 40–45 articles; proximal flagellar articles wider than long, conjoint, not swollen, basal articles near width of article 6. Mandibular molar normal, elongate, straight-sided, distally truncate; palp large with elongate first article and setose straight distal article. Maxillipedal endite longer than wide, broader than palp; palp articles 4–5 straight-sided, elongate, narrower than palp articles 1–3. Pereopod I carpus leg-like; propodus with 3 spine-like setae and numerous ctenate scales; carpus with only fine setae in 2 rows. Pereopod II–VII dactyli with only 2 distal claws, ventral claw near same size as dorsal claw. Male pleopod I with short but distinct medial and lateral lobes; medial lobe setose and rounded; lateral lobe short and roughly triangular with slight terminal notch for stylet guide. Male pleopod II not modified; proximal article of endopod near maximum width of stylet; stylet shorter than protopod, only slightly curved. Pleopod III endopod truncate with 6–8 plumose setae; exopod distally rounded, finely setose, narrower and shorter than endopod, with 2 free articles, interior suture at angle to body axis. Uropods reduced, distinctly shorter than pleotelson; with squat rami and protopod; rami shorter than protopod; uropod exopod apical.

Remarks

The affinities of *Hawaianira* are somewhat unclear because this genus has characters of an unspecialised *Joeropsis* or *Caecijaera* (see Miller 1967). However, *Hawaianira* shares several apomorphies with *Caecijaera*: short broad uropods and antennular first articles

(seen also in *Janthura* and *Neojaera*), a broad flattened body, and a broad pleopod III endopod with many plumose setae. *Janira caudata* Richardson, 1910 appears to belong in this genus, not in *Ianthopsis* as suggested by Wolff (1962). H.-G. Müller (in litt.), reports discovering a new species of *Hawaianira* from Réunion Island.

Heterias Richardson, 1904*a*

Janirella Sayce, 1900: 124
Heterias Richardson, 1904*a*: 6.
Pseudasellus Chappuis, 1951: 7.
Fritzianira Castro and Lima, 1977: 1.

Type species: *Heterias pusilla* (Sayce, 1900).

Species Included

Janirella pusilla Sayce, 1900: 124; *Janira exul* Müller, 1892: 209; *Pseudasellus nichollsi* Chappuis, 1951: 7; *Heterias petrensis* Roberts, 1975: 21.

Other References

Heterias.—Barnard, 1927: 161; Nicholls, 1929: 290, 295; Wolff, 1962: 39, 41, 236, 276, 281, 290; Williams, 1968: 145; 1974: 88; 1980: 155–8; Bowman *et al.*, 1987: 275; Horwitz and Knott, 1991: 29–32.

Fritzianira.—Castro and Lima, 1977: 1; Ringuelet, 1981: 88; Taberner, 1982: 19; Bowman *et al.*, 1987: 278.

Janiropsis.—Van Name, 1942: 323; Roberts, 1975: 30.

Pseudasellus.—Wolff, 1962: 39, 207, 250, 276, 281, 290; Williams, 1974: 88; 1981: 1116.

Parasellidae sp.—Bachman, 1964: 491.

Diagnosis

Body broad, lateral margin broadening posteriorly to broad pleotelson, with many fine setae. Cephalon lateral margin rounded, lacking spines or denticles; eyes dorsal if present; vertex straight or rounded, lacking rostrum. Pereonites laterally rounded or truncate, coxae not visible in dorsal view (in subgenus *Heterias*), or anterior pereonites laterally concave, coxae slightly visible in dorsal view on pereonites 2–7 (in subgenus *Fritzianira*) . Pleonite 1 extremely short and narrower than pleotelson or pereonite 7. Pleotelson broader than anterior pereonites; lateral margins rounded, lacking denticles or incision for uropods. Antennula short but not compact; article 1 short and broad, length near width; flagellum with 3–4 articles. Antenna elongate; basal articles 1–4 subequal, article 3 with (subgenus *Heterias*) or without (subgenus *Fritzianira*) scale; articles 5–6 distinctly longer than basal articles 1–4; flagellum with more than 20 articles, proximal articles separate, longer than wide, not conjoint. Mandible normal; molar process distally truncate, only slightly tapering; palp large and functional, near length of mandible body, proximal article elongate, distal article slightly curved and setose. Maxillipedal endite longer than wide, narrower than palp; palp articles 4–5 narrower than palp articles 1–3. Pereopod I leg-like, carpus not enlarged, with few or no spine-like setae; propodus with only fine setae. Pereopod II–VII dactylus with only 2 distal claws, with ventral claw shorter than dorsal claw but approximately of same proximal width. Male pleopod I with well-differentiated medial and lateral lobes; lateral lobes point laterally; medial lobes broad, near width of pleopod, distal flattened and dorsally curved. Male pleopod II proximal article of endopod enlarged, decidedly rounded, and thicker than stylet; stylet much longer than sympod, distal part thin and coiling. Pleopod III endopod with no plumose setae; exopod longer and broader than endopod, with no plumose setae and 2 free articles sutured at angle to body axis. Uropods slender, overall length subequal to pleotelson length; exopod inserting apically; protopod shorter than rami.

Remarks

The unique copulatory apparatus on the male pleopods is a distinctive apomorphy of *Heterias*. This feature has been unevenly described in most species and should be carefully restudied (Bowman *et al.* 1987 provide scanning electron micrographs). Other features of *Heterias* include a *Jaera*-like body form (broadening posteriorly), 2 claws on the walking legs, long slender uropods, a short antennula with only three articles in the flagellum, a long antenna with more than 20 articles, and a pleopod III with no plumose setae on the endopod.

Wolff (1962) assigned *Janira exul* to *Heterias*, but De Castro and Lima (1977) apparently were unaware of this assignment as well as of Robert's (1975) work when they created *Fritzianira* for this species. *Fritzianira* currently is a junior synonym of *Heterias*, but Bowman *et al.* (1987) retained this name for a subgenus because *H. exul* lacks the antennal scale seen in the Australian and Tasmanian species. Williams (1968, 1974) suggested that *Pseudasellus nichollsi* Chappuis, 1951 belongs in *Heterias*, owing to the similarity of the male pleopods. *H. petrensis* Roberts retains eyes and an antennal scale, suggesting that it may be the least-derived species of the genus. Both Chappuis (1951, his fig. 21) and Roberts (1975, his fig. 6*b*) mistook a juvenile male as an intersex of the species. In both papers, buds of male pleopods are shown developing inside the female operculum, typical of most janiroideans (e.g. Wilson 1981, his fig. 10*C*).

The distribution of *Heterias* in fresh waters of South Australia, Tasmania and South America suggests that this genus is an ancient Gondwanaland relict (Bowman *et al.* 1987), much like the protojanirid and phreatoicidean isopods. On the other hand, marine janirid taxa are being found in increasing numbers, so the presence of a marine *Heterias*-like form should not be discounted. Indeed, a *Heterias*-like isopod has been reported from the Galapagos Islands (Brusca 1987), although these undescribed specimens may not fit comfortably into *Heterias*. Bowman *et al.* (1987) mention that some of their specimens came from tidally influenced streams, possibly indicating a close association with marine waters. Moreover, Bowman *et al.* (1987) did not attempt to explain the disjunct distribution of *Heterias exul* between Brazil and Chile. If this 'species' is derived from marine ancestors, its distribution would indicate multiple invasions of freshwater. Another possibility is that *Heterias* may not be monophyletic. The distinctive male copulatory morphology, under such a hypothesis, would be homoplastic and uninformative about relationships. Further morphological study of this genus is therefore warranted to distinguish among these possibilities.

Iais Bovallius, 1886

Iais Bovallius, 1886: 50–2.
Jais Cléret, 1973: 32.
Neoectias Winkler, 1992: 174.

Type species: *Jaera pubescens* Dana, 1852.

Species Included

Jaera pubescens Dana, 1852: 744 (Atlas, 1855, plate 49, fig. 9*a–d*) (senior synonym of *Iais hargeri* Bovallius, 1886: 50, originally designated type); *I. aquilei* Coineau, 1977: 424; *I. elongata* Sivertsen & Holthuis, 1980: 103; *I. solangeae* Coineau, 1985: (ref. in Coineau, 1986: 468); *Janiropsis californica* Richardson, 1904*c*: 223 (senior synonym of *I. pubescens longistylis* Chilton, 1912: 132); *Iais singaporensis* Menzies & Barnard, 1951: 136; *Neoectias chilense* Winkler, 1992: 174; *Protocharon antarctica* Chappuis, 1958: 16.

Other References

Iais.—Dollfus, 1891: 70; Stebbing, 1900: 549; Chilton, 1909: 649; Ortmann, 1911: 645–6; Barnard, 1914: 436; Vanhöffen, 1914: 530; Giambiagi, 1925: 17; Monod, 1926: 13, 1931*a*: 1; 1931*b*: 13; Stephensen, 1927: 356; Nordenstam, 1933: 177; Hale, 1937: 31; Kesselyák, 1938: 221; Nierstrasz, 1941: 287; Menzies, 1952: 135; Pillai, 1954: 19; Hurley, 1956: 715,

1961: 262; Holdgate, 1961: 14, 19; Menzies, 1962*b*: 74; Wolff, 1962: 39, 236, 251, 276, 293; Barnard, 1965: 199; Kussakin, 1967: 308; Schultz, 1969: 269; Coineau, 1971: 134–5; Rotramel, 1972: 194; 1975: 21, 247; Iverson, 1974: 165; Miller, 1975: 149; Kensley, 1978: 135–6; Kussakin and Vasina, 1980: 361; Marsden, 1982: 233; Coineau, 1986: 468, 472; Kussakin, 1988: 135; Branch *et al.*, 1991: 28; Müller and Brusca, 1992: 73.

Jaera.—Smith, 1876: 63; Beddard, 1886*b*: 19–20.

Janiropsis.—Richardson, 1904*b*: 666; 1905*b*: 455.

Protocharon.—Wolff, 1962: 38, 250.

Diagnosis

Diminutive isopods with pereonites often broadening posteriorly. Cephalon lateral margin rounded, not elaborate or spined; vertex convex but not rostrate; eyes dorsal, reduced to few separate ocelli. Tergites of all pereonites with slight rounded anterolateral projections on pereonites 1–4; all coxae visible in dorsal view emerging from posterior margin of each pereonite. Pleonite 1 dorsally separate, short, distinctly narrower than pereonite 7 and near same width (more than approximately 75%) of pleotelson. Pleotelson ovoid, small, narrower than pereonite 7, lacking deep incisions for uropods or denticles. Antennula article 1 much broader than article 2 but length greater than width, distally rounded; flagellum short, with 3 articles. Antenna basal articles (1–4) subequal, article 3 lacking scale; articles 5 and 6 somewhat longer than basal articles 1–4 but shorter than length of head; flagellum long, with 20–25 articles, proximal articles separate and longer than wide, not conjoint. Mandible slender but normal; molar process distally truncate, straight-sided or slightly tapering distally; palp large, near length of mandible, proximal article long and near length of distal article, distal article slightly curved and setose. Maxillipedal endite length near width, either wider or near width of palp article 2; palp articles 4–5 narrow and straight-sided, palp article 3 only slightly wider than palp articles 4–5 and distinctly narrower than broad palp articles 1–2. Pereopod I leg-like, with carpus and propodus straight-sided with few fine setae and no spine-like setae. Pereopods II–VII stout, but ambulatory, dactyli with 3 claws, ventral claw near length and basal width of dorsal claw, accessory seta enlarged into third claw near length of ventral claw. Male pleopod I medial and lateral lobes short, distinctly separated and posteriorly projecting; lateral lobes distally pointed and subtriangular. Male pleopod II endopod proximal article near maximum width of stylet; stylet shorter than length of protopod, only slightly curving. Pleopod III endopod and exopod entirely lacking plumose setae; exopod thin, distally pointed, longer and narrower than endopod, biarticulate with suture at angle to body axis. Uropods short, distinctly shorter than pleotelson; protopod rectangular, near length of rami; exopod shorter than endopod, inserting apically.

Remarks

Like *Jaera*, the body of *Iais* tends to expand posteriorly, although the pleotelson is narrower, not wider, than the last pereonite. In the non-ectocommensal species, the pereonal expansion is much less pronounced. Several behavioural similarities (discussed below) with a species of *Jaera* suggest perhaps a close relationship between the two genera (see also cladogram in Vieulle 1979). *Protocharon* shares a general body form with *Iais*, although *Protocharon* (among other differences) has only two claws on the walking legs rather than three as in *Iais*.

The nominal species, *I. pubescens*, is morphologically variable and broadly distributed in the subantarctic (many publications with *Iais* in the synonymy above contain illustrations of *I. pubescens*). This species may be a complex of species, requiring a detailed revision. If the Falkland Island species *I. hargeri* were found to be distinct from *I. pubescens* from Tierra del Fuego, the type of *Iais* would be *I. hargeri*, as indicated by Bovallius (1886).

A study of Chappuis' (1958) description of *Protocharon antarctica* led us to the inescapable conclusion that this species is a member of *Iais* (see discussion of *Protocharon*). Coineau (1986: 472, footnote), in describing *I. aquilei*, agrees with this observation. A similar species, *I. chilense*, was originally presented as a new genus, *Neoectias*, but Winkler (1992) disregarded similarities of this species with *I. aquilei*.

Iais singaporensis Menzies & Barnard, 1951 was synonymised to *I. californica* (see Hurley 1956; Rotramel 1972) in recognition that the widespread sphaeromatid host, *Sphaeroma quoyanum* Milne-Edwards, 1840 might have carried its commensal worldwide on wooden ships. More recently, *I. singaporensis* has been redescribed and recognised as a distinct species (Müller and Brusca 1992). Because *I. pubescens longistylis* Chilton, 1912 inhabits a variety of host sphaeromatids in New Zealand (Hurley 1956), the synonymy of this species with *I. californica* also may be in doubt.

The species of *Iais* that live ectocommensally on large sphaeromatid isopods are found in most oceans. Interestingly, *Jaera hopeana* shares this habit. Exceptions exist: *I. aquilei*, *I. antarctica* and *I. chilense* were found interstitially at or near sea level (Chappuis 1958; Coineau 1977; Winkler 1992); specimens of '*I. pubescens*' were found free-living in freshwater streams and pools above sea level (Chilton 1909; Holdgate 1961; Barnard 1965); *I. elongata* was found free-living in 'a pool of brackish water 2 m above the beach' (Sivertsen and Holthuis 1980:106). Australian Museum collections from Macquarie Island have three species of *Iais* that occur in all three environments mentioned above (G.D.F.W., unpublished observations).

Mature males of *I. aquilei* were observed by Coineau (1977) to carry manca stage individuals with their specialised fourth pereopods. *I.* cf. *pubescens* from Macquarie Island also has this habit. Müller and Brusca (1992) suggest that the reduced male pereopod IV may be diagnostic of the genus, although *J. hopeana* has a similarly specialised limb (Franke 1993). This behaviour may be an extended form of precopula (Wilson 1991). Females of small janiroidean species are functionally capable of receiving sperm via their spermathecal duct ('cuticular organ', see Vieulle 1977), prior to preparatory stage (Franke 1993; unpublished observations on *Pleurocope* and other genera). Sperm are held by the juvenile female until she enters the brooding stage. Therefore, an adult male's fitness would benefit if he were to hold a female prior to her becoming sexually receptive. Precopula is widely observed in isopods (Ridley 1983), and this behaviour is advanced to an earlier stage owing to the uniqueness of the janiroidean genital system (Wilson 1991). The manca-holding behaviour by males is precopula rather than offspring-holding as in the brooding females (Franke 1993). Manca-holding behaviour has been observed in other species of *Iais* (B. Kensley, personal communication), in *Munna* (R. Hessler, personal communication), and in *Jaera hopeana* (Veuille 1979; Franke 1993). This behaviour may be more common in janiroideans than previously realised.

Ianiropsis Sars, 1897*a*

Ianiropsis Sars, 1897*a*: 102.
Janiropsis Richardson, 1904*c*: 221.

Type species: *Janira breviremis* Sars, 1883.

Species Included

I. analoga Menzies, 1952: 141; *Janira breviremis* Sars, 1883: 64; *I. chiliensis* Menzies, 1962*b*: 80; *I. epilittoralis* Menzies, 1952: 149; *I. kincaidi* Richardson, 1904*c*: 221; *Janiropsis derjugini* Gurjanova, 1933: 82; *I. koreaensis* Jang & Kwon, 1990: 195; *I. kussakini* Carvacho, 1982: 200; *I. longiantennata* Thielemann, 1910: 70; *I. longipes* Sivertsen & Holthuis, 1980: 109; *I. magnocula* Menzies, 1952: 145; *I. minuta* Menzies, 1952: 155; *I. montereyensis* Menzies, 1952: 152; *Janira neglecta* Chilton, 1909: 648; *I. notoensis* Nunomura, 1985*a*: 130; *I. pallidocula* Kussakin, 1962: 44; *I. palpalis* Barnard, 1914: 222; *I. perplexus* Menzies, 1962*b*: 78; *I. picta* Kussakin & Mezhov, 1979: 151; *I. punctulata* Kussakin & Mezhov, 1979: 153; *Janiropsis serricaudis* Gurjanova, 1936*a*: 251; *I. setifera* Gurjanova, 1950: 282; *I. tridens* Menzies, 1952: 156; *I.* sp. Nunomura, 1985*b*: 109.

Other References

Ianiropsis.—Barnard, 1955: 75; Spasski, 1961: 296; Wolff, 1962: 39, 234, 235, 251, 254, 276, 287, 292, 300; Kussakin, 1967: 339 (English translation 1968: 341); George and

Strömberg, 1968: 235; Miller, 1968: 24; Schultz, 1969: 261; Kussakin, 1972: 164, 1974: 258; Monod, 1974: 1133; Kussakin, 1975: 67; Kensley, 1976: 305–7; Kussakin, 1988: 88.

Ianthopsis.—Wolff, 1962: 41, 251; Iverson, 1974: 165.

Janira.—Stephensen, 1927: 355; Nierstrasz, 1941: 283; Hatch, 1947: 171; Hurley, 1961: 262; Kussakin, 1967: 339; 1968: 341.

Janiropsis.—Richardson, 1905*b*: 456; Gurjanova, 1935: 30; 1936*b*: 44; 1938: 231; Nierstrasz, 1941: 285; Hatch, 1947: 172; Gurjanova, 1950: 281; Kussakin, 1956: 114; Hauksson, 1980: 32; Nunomura, 1981: 44; Kensley, 1989: 148.

Diagnosis

Medium-sized, somewhat elongate janiroideans. Cephalon broad, laterally rounded or quadrate, lacking large spines; vertex smoothly convex, lacking rostrum; eyes dorsal. Body moderately broad, pereonites all near same length or widest medially; tergites of pereonites 2 and 3 laterally concave with reduced lappets; all coxae visible in dorsal view. Pleotelson broad, shield-shaped, laterally rounded, sometimes with small denticles on lateral margins anterior to shallow insertions of uropods. Antennula basal article only slightly broader than second article; flagellum multiarticulate, with around 5–25 articles (median 10 articles). Antenna elongate; basal articles 1–4 subequal, article 3 with distinct scale; articles 5–6 much longer than articles 1–4; flagellum multiarticulate, generally more that 20 articles; proximal flagellar articles narrower than antennular article 6, not conjoint, wider than long except most proximal article (generally longer than wide). Mandibles normal with truncate molar process and elongate palp; palp article 3 curved and setose. Maxillipedal endite longer than broad, narrower than broad palp; palp articles 4–5 thin, straight-sided, narrower than palp articles 1–3, in males of some species longer than antennulae; palp article 3 much wider than long, medial margin tapering from broadest point distally. Pereopod I of male extremely long; carpus elongate, with 2 rows of spine-like sensory setae, basis and ischium also much longer than in posterior legs; propodus with row of spine-like sensory setae. Pereopod I in female similar to more posterior walking legs. Pereopods II–VII dactylus with 2 large subequal distal claws and third large subdistal accessory claw. Male pleopod I distal tip with medial lobes straight or only slightly rounded, merging smoothly into pointed lateral lobes with no separating notch; lateral lobes not curling medially. Stylet of male pleopod II not coiled and not longer than sympod. Pleopod III endopod with distinct gap between medial plumose seta and 2 lateral plumose setae; exopod of both sexes narrower and longer than endopod; exopod with 2 articles, distally rounded or pointed and lacking plumose setae, suture perpendicular to ramal axis. Uropods large, often near length of pleotelson (but short and squat in some species); rami and sympod narrow; exopod near length of endopod, inserting apically; protopod shorter than endopod.

Remarks

Ianiropsis is a broadly distributed shallow-water genus. Its features are similar to those of *Janira* and *Carpias*, including three claws on the walking legs, coxae visible in dorsal view, and small pereonal lappets in some species. Its most distinctive apomorphy is an elongate male pereopod I, although the carpus is not broad and spiny as in *Carpias*; the elongation is especially apparent in the basis and ischium. Moreover, the distal tip of the first pleopod of *Ianiropsis* males is very similar in most species: a broad nonprojecting medial lobe curving smoothly into the laterally pointed lateral lobes. In view of the variability of this feature in most other janirids, the constancy of the male pleopod I in *Ianiropsis* is somewhat surprising, although very useful. Sars (1897*a*) mentions that the antennulae of *I. breviremis* are different from those of *Janira maculosa* (they are shorter), but the simple length of antennulae and antennae cannot be trusted as a generic character. As in several other janirid genera, *Ianiropsis* can only be definitively identified from the males (see remarks under *Janira*).

Ianiropsis bisbidens Barnard, 1955, placed in *Janira* by Carvacho (1981), has broad, leaf-like uropods, large third pleopods, and first male pleopods with long medial lobes and short but protruding lateral lobes. All these features indicate that this species is a member of the genus *Iathrippa*.

The species *Janira neglecta* Chilton, 1909 was placed by Wolff (1962) into *Ianthopsis*, although the male first pereopod clearly has an elongated but not expanded carpus, an apomorphy of *Ianiropsis*. In addition, the figured pleotelson is more typical of *Ianiropsis* and its allies than of *Ianthopsis*, which typically has tubercles and thick spines on the dorsal and lateral surfaces. The species *neglecta* should be assigned provisionally to *Ianiropsis*.

Menzies (1952) considered *I. kincaidi* Richardson and *I. derjugini* Gurjanova as subspecies of *I. kincaidi*. Separate morphological diagnoses, illustrations, and positions in a key were provided for each presumed subspecies, and Menzies even reported that each form lives in a separate part of the intertidal zone. He gave no evidence for substantial genetic introgression between the two taxa. Therefore, we consider these two taxa separate and distinct species. The sympatry of *I. kincaidi* and *I. derjugini* and the relationship between Monterey County (California) and Komandorski Islands (Bering Sea) populations deserves more study. Kussakin (1982) and Jang and Kwon (1990) also consider *I. kincaidi* and *I. derjugini* to be separate species but do not mention the sympatry problem of Menzies (1952). Several cryptic species may be classified as *I. kincaidi*.

Two distinct groups are apparent within *Ianiropsis*. The *palpalis*-group has enhanced sexual dimorphism in the form of an elongate male maxillipedal palp; this group includes *I. palpalis* Barnard, 1914, *I. serricaudis* Gurjanova, 1936, *I. notoensis* Nunomura, 1985*a*, and *I. epilittoralis* Menzies, 1952. Males of the *palpalis*-group have maxillipedal palps that protrude well beyond the basal articles of the antenna in dorsal view. The elongation is greatest in the fifth and fourth articles, although the third article is also much longer than wide. In most other *Ianiropsis* species, the maxillipedal third article is shorter than wide, on the basis of literature descriptions. *I. epilittoralis* was not described as having this enlarged male palp, although an inspection of specimens from San Diego, California shows that it, too, belongs to the *palpalis*-group. If the enlarged male palp was omitted from other descriptions, this character may have a more widespread distribution among species of *Ianiropsis*. The second group, the *picta*-group, includes two species by Kussakin and Mezhov (1979): *I. picta* and *I. punctulata*. This group has a robust maxillipedal palp with short stocky distal articles. Maxilliped article 5 is shorter than wide, while descriptions of all other *Ianiropsis* species show article 5 being longer than wide.

Iathrippa Bovallius, 1886

Iathrippa Bovallius, 1886: 31.
Notasellus Pfeffer, 1887: 85.
Jorina Nierstrasz, 1918: 134.
Iantra (*Iathrippa*) Nordenstam, 1933: 278 (*lapsus calami*).

Type species: *Janira longicauda* Chilton, 1884.

Species Included

Ianiropsis bisbidens Barnard, 1955: 75; *Janira capensis* Barnard, 1914: 220; *Jorina chiliensis* Nierstrasz, 1918: 134; *Janira hirsuta* Carvacho, 1981: 135; *Stenetrium inerme* Haswell, 1881: 479; *Janira longicauda* Chilton, 1884: 250; *I. menziesi* Sivertsen & Holthuis, 1980: 99 (=*I. chiliensis* Menzies, 1962*a*: 70; see Sivertsen and Holthuis 1980); *I. multidens* Menzies, 1962*b*: 72; *Notasellus sarsi* Pfeffer, 1887: 85; *Notasellus trilobatus* Richardson, 1910: 649; *Janira tristani* Beddard, 1886*a*: 105.

Other References

Iathrippa.—Hutton, 1904: 264; Nierstrasz, 1941: 286; Hurley, 1957: 17; Wolff, 1962: 39, 41, 234, 235, 277, 294, 300; Kussakin, 1967: 339; Schultz, 1976: 17; Kussakin and Vasina, 1980: 363.

Ianira (*Iathrippa*).—Nordenstam, 1933: 172; Hurley, 1961: 262.

Janira.—Beddard, 1886*b*: 6; Thomson and Chilton, 1886: 157; Thomson, 1888: 265; Stebbing, 1905: 49; Nierstrasz, 1918: 134; Tattersall, 1921: 200; Stephensen, 1947: 7; Barnard, 1955: 6; Wolff, 1962: 42, 251; Kensley, 1976: 303; 1989: 148.

Notasellus.—Hodgson, 1902: 251; Richardson, 1906: 13; Hodgson, 1910: 49; Richardson, 1913: 17; Vanhöffen, 1914: 532; Tattersall, 1921: 202; Giambiagi, 1925: 16; Hale, 1937: 31; Schultz, 1976: 17; Kensley, 1978: 139; Kussakin and Vasina, 1980: 364; Kussakin, 1982: 89; Wilson, 1986*a*: 297; 1987: 264; Branch *et al.*, 1991: 29.

Stenetrium.—Haswell, 1882: 309; Whitelegge, 1889: 60; Bovallius, 1886: 21.

Diagnosis

Moderately broad janiroideans with setose dorsal surfaces. Cephalon broad, lateral margins rounded, without spines; vertex with small to elongate rostrum protruding from frons; eyes lateral, sometimes bulbous on distinct projections. Pereonites laterally concave with all coxae visible in dorsal view, small but distinct lappets present on pereonites 2–4. Pleonite 1 short, distinctly narrower than pereonite 7 and pleotelson. Pleotelson broad, laterally rounded and smooth, sometimes with small angular projections lateral to insertions of uropods; anal part of pleotelson demarcated by small rounded posterior projection. Antennula basal article only slightly broader than second article, with multiarticulate flagellum (more than 15 articles). Antenna with elongate, multiarticulate flagellum; basal articles 1–4 subequal, article 3 with large scale; articles 5–6 elongate, much longer than articles 1–4; proximal flagellar articles longer than wide, not conjoint. Mandibles normal with truncate molar process and elongate palp; distal article elongate and setose. Maxillipedal endite longer than wide; palp basally broader than endite; palp articles 4–5 elongate, straight-sided, narrower than palp articles 1–3. Pereopod I leg-like, enlarged in male; carpus robust, setose, with 2 rows of spine-like sensory setae. Pereopod II–VII dactylus with 2 large subequal distal claws and third large subdistal accessory claw. Male pleopods I and II not opercular, distinctly smaller than pleopod III exopod. Male pleopod I distal tip with distinctly separate medial and lateral lobes; lateral lobes pointing laterally and posteriorly; medial lobes distinctly longer than lateral lobes. Male pleopod II endopod proximal article somewhat larger than maximum width of stylet, not enlarged or inflated; stylet subequal to or longer than sympod. Opercular female pleopod II with distal indentation. Pleopod III endopod with distinct gap between medial seta (sometimes 2 medial setae) and 2 lateral setae; exopod of both sexes with 2 articles, distally rounded, lacking plumose setae; exopod of male broader and longer than endopod, opercular; exopod of female narrower and longer than endopod. Uropods large, with broad flattened rami; rami much longer than sympod; exopod shorter than endopod, inserting apically.

Remarks

Iathrippa, like some species of *Jaera*, retains the asellotan plesiomorphic structure of the pleopods in the adult male: pleopods I and II are much smaller than pleopod III and the latter is opercular (Wilson 1987). Other distinctive characters of the genus are the large uropods with flattened rami, a pointed or rounded rostrum, and usually large protruding eyes. Of these characters, the enlarged, generally leaf-like uropods are the most useful synapomorphy of *Iathrippa* species.

Iathrippa has been subject to some confusion because a junior synonym, *Notasellus*, was named one year after the first species was described, and later workers tended to mix the classifications of the New Zealand and South American/Antarctic species. Nordenstam (1933) established the synonymy, although his concept is almost certainly too broad. The most recent, full discussion of the genus was by Schultz (1976), in which the species in the two genera were separated only by the number of claws on the pereopods: two claws in the former and three in the latter. Wilson (1986*a*, 1987) followed Schultz's (1976) classification in referring to *I. sarsi* as *Notasellus sarsi*. Nevertheless, the species assigned to these two genera are so similar that they should be classified together. The species reported to have two claws should be restudied; if they indeed do lack the third claw, then this must be considered a secondary reduction within the genus. Indeed, subantarctic specimens attributed to *I. longicauda* have been reported (but see below) to have 3 claws (Kussakin and Vasina 1980). *I. inerme* Haswell, 1881 has three claws, as an inspection of material in the Australian Museum collection has shown. The third claw in *I. inerme* is present as a large subterminal accessory seta and therefore might be not classified as a third claw by

previous workers; this may also be the case in *I. longicauda*. Sivertsen and Holthuis (1980) did not use Schultz's division of the species, and maintained the junior synonymy of *Notasellus*. These latter authors also created a new species name, *I. menziesi*, for the junior homonym *I. chilensis* Menzies, 1962*a*, not *I. chilensis* (Nierstrasz, 1918).

Janira hirsuta Carvacho, 1981 belongs in *Iathrippa*, although the species has been drawn coarsely without a rostrum. In addition to its broad uropodal rami, which help define the species as *Iathrippa*, the male pleopod III is much larger than pleopod II. As mentioned above, *Janiropsis bisbidens* Barnard, 1955 belongs in *Iathrippa*. Kensley (1978) assigned *Janira capensis* Barnard, 1914 to *Notasellus*, which is here considered a junior synonym of *Iathrippa*.

The species *Iathrippa longicauda* is subject to further confusion, in addition to the problem of the number of dactylar claws. This species, originally described from New Zealand, has been attributed to specimens collected from numerous subantarctic islands, as well as South America (see synonymy and distribution in Kussakin and Vasina 1980). This broad distribution and variety of habitats listed in the records suggests that *I. longicauda* is a complex of species.

Jaera Leach, 1814

Iaira Meinert, 1877: 80.
Joera Koehler, 1885: 1–2.
Iaera Sars, 1897*a*: 103.
Jaera Leach, 1814: 434.
Jaeridina Milne-Edwards, 1840: 150.
Metajaera Verhoeff, 1943: 283.

Type species: *Jaera albifrons* Leach, 1814.

Species Included

Jaera albifrons Leach, 1814: 434; *Janira nordmanni* Rathke, 1837: 388; *J. bocqueti* Veuille & Kocatas, 1979: 597; *J. caspica* Kesselyák, 1938: 240; *J. forsmani* Bocquet, 1953: 225; *J. hopeana* Costa, 1853: 1; *J. ischiosetosa* Forsman, 1949: 455; *J. istri* Veuille, 1979: 208; *J. italica* Kesselyák, 1938: 238; *Janira nordmanni* Rathke, 1837 (= *Jaera nordmanni nordmanni* Lemercier, 1960); *J. nordmanni guernei* Dollfus, 1889: 133; *J. nordmanni illyrica* Veuille, 1979; *J. nordmanni massiliensis* Lemercier, 1958*b*: 3688; *J. nordmanni nordica insulana* Veuille, 1976*b*; *J. nordmanni occidentalis* Veuille, 1979: 206; *J. nordmanni illyrica* Veuille, 1979: 206; *J. nordmanni balaerica* Jaume & Garcia, 1990: 85; *J. nordmanni brevicaudata* Jaume & Garcia, 1990: 81; *J. nordica* Lemercier, 1958*b*: 3688; *J. petiti* Schulz, 1953: 59; *J. posthirsuta* Forsman, 1949: 457; *J. praehirsuta* Forsman, 1949: 458; *J. sarsi* Valkanov, 1936: 314; *J. schellenbergi* Kesselyák, 1938: 232; *J. sorrentina* Verhoeff, 1943: 284; *J. syei* Bocquet, 1950: 1; ?*Joera wakishiana* Bate, 1865: 668.

Other References

Jaera.—Delage, 1881: 155; Sye, 1887: 1; Zirwas, 1910: 94; Hansen, 1916: 12; Monod, 1925: 238; Gurjanova, 1932: 21; Arcangeli, 1934: 280; Valkanov, 1938: 57; Strouhal, 1942: 150; 1954: 15; Forsman, 1944: 1; Verhoeff, 1949: 422; Birstein, 1951: 136; Margalef, 1952: 209; Karaman, 1953: 102; Margalef, 1953: 106; Staiger and Bocquet, 1956: 10; Renault, 1958: 63; Lemercier, 1958*a*: 86; 1960: 23; Wolff, 1962: 21, 40, 235, 276, 291, 297; Lécher, 1962: 561; Prunus, 1963: 2043; Bocquet and Prunus, 1963: 343; Gruner, 1965: 127; Haahtela, 1965: 309; Haahtela and Naylor, 1965: 367; Naylor and Haahtela, 1966: 209; 1967: 19; George and Menzies, 1968: 381; Schultz, 1969: 269; Kussakin, 1969: 427; 1988: 137; Steele and Steele, 1972: 205; Naylor, 1972: 52; Geldiay and Kocatas, 1972: 25; Schiecke, 1973: 154; Jones, 1974: 727; Bubel and Jones, 1974: 737; Monod, 1975: 240; Veuille, 1976*a*: 1235; 1976*b*: 1334–7; Pantoustier and Prunus, 1977: 361; Cariou, 1977: 6; 1985: 281; Veuille, 1978*a*: 300; 1978*b*: 391; Radu, 1979: 177; Ingolfsson, 1980: 97; Solignac, 1981: 387; Klochenko, 1986: 85; Sket, 1990: 44; Reboreda and Otero, 1990: 73; Franke, 1993: 65.

Asellus.—Bate and Westwood, 1868: 320.

Iaera.—Sars, 1897*b*: 298; Hansen, 1916: 12; Nierstrasz, 1941: 286.
Joera.—Bate, 1866: 282.
Oniscus.—Fabricius, 1780: 252.
Metajaera.—Verhoeff, 1949: 419; Birstein, 1951: 139; Kussakin, 1988: 154.

Diagnosis

Body moderately broad, tergites subequal or becoming more broad posteriorly (in males). Cephalon lateral margin rounded, lacking spines; anterior margin with rounded vertex and rounded frons protruding between antennae; eyes dorsal, generally well developed. Pereonites broad, laterally rounded, coxae not visible in dorsal view. Pleonite 1 dorsally separate, short, distinctly narrower than pereonite 7 or pleotelson. Pleotelson same width as anterior pereonites (in males) or narrower; lateral margins of pleotelson without denticles; incisions for uropods merged into single posterior notch. Antennular article 1 flattened, squat but longer than wide; flagellum with 2–3 articles. Antenna basal articles (1–4) subequal, article 3 without scale; articles 5 and 6 longer than basal articles 1–4; flagellum with more than 20 articles; proximal articles separate and longer than wide, not conjoint. Mandibular molar normal distally truncate, parallel-sided or slightly tapering posteriorly; palp large, distal article curved and setose. Maxillipedal endite longer than wide; palp narrower or broader than endite; palp articles 4–5 straight-sided, narrower than broad palp articles 1–2; palp article 3 distally narrowing to width of palp articles 4–5, distinctly narrower than palp article 2. Pereopod I leg-like, carpus not enlarged, with no spine-like setae. Pereopod II–VII dactylus with 3 claws, ventral claw near same size as dorsal claw, accessory seta enlarged into third claw. Male pleopod I broad, lateral lobes with projecting copulatory horns (laterally or ventrally); medial lobes various, but always distinct from lateral lobes. Male pleopod II proximal article of endopod width greater than width of stylet, but not enlarged and rounded; stylet elongate and curving, but not distally thin and coiled. Pleopod III endopod with no plumose setae; in males endopod narrower and shorter than exopod (especially when opercular); exopod without plumose setae, with 2 free articles at distinct angle to body axis. Uropods inserting adjacent to one another, reduced, distinctly shorter than pleotelson, with squat rami and sympod; exopod apex distinctly shorter than endopod; sympod longer than rami.

Remarks

Jaera has been known for nearly two centuries and, of all Janiroidea, probably has the best known behaviour, sexual biology and genetics. Living in shallow intertidal, brackish or freshwater habitats makes species of *Jaera* readily accessible to researchers. Some species are hardy and are easily cultured (Solignac 1981). The exact number of valid species is difficult to establish, as some species are polymorphic (i.e. the '*albifrons*' complex or superspecies: Solignac 1981). *Jaera nordmanni* has several local races adapted to brackish or fresh water and Jazdzewski (1969) shows that some species can interbreed (e.g. *J. syei* with *J. ischiosetosa*). Veuille (1979) provides a useful review of some species, and their historical zoogeography around the Mediterranean. Although the variation observed in *Jaera* has prompted many authors to recognise numerous subspecies in larger superspecies, Veuille (1979) regards many subspecific forms as species. Veuille, however, also recognises several additional subspecies, such as the subspecific race *insulana* in *J. nordmanni nordica* (Veuille 1976*b*), which is listed here in the species list.

Despite polymorphism at the species level, the genus *Jaera* is easily recognised. The body is broad, sometimes becoming more so posteriorly. The cephalon has lateral projections and the eyes are sessile on the dorsal surface. The broad rounded pleotelson has a posterior indentation that bears abbreviated uropods. The antennula is short with only a few articles, while the antenna can be as long as the pereon. Some species have the primitive configuration of the male pleopods as seen in *Iathrippa*: the pleopods I and II are smaller than pleopod III, and the latter is more or less opercular (e.g. illustrations of *J. nordmanni* in Karaman 1953). This janiroidean plesiomorphy cannot be used as evidence for a close relationship between *Jaera* and *Iathrippa*.

Jaera has two recognised subgenera (Kussakin 1988) with all species except one in *J. Jaera*, and *Jaera hopeana* in subgenus *Metajaera* Verhoeff, 1943. *J. Metajaera* can be separated from *J. Jaera* by an indistinct incision in the pleotelson for the uropods. Veuille (1979: 197–8) additionally recognises four separate groups and provides characters for their recognition: 'groupe Atlantique', including the *J. albifrons* superspecies (*J. albifrons, J. ischiosetosa, J. posthirsuta, J. praehirsuta, J. forsmani*); 'groupe méditerranéen', including *J. italica, J. schellenbergi, J. nordmanni, J. nordica, J. massiliensis, J. bocqueti*; 'groupe ponto-caspien', including *J. sarsi, J. caspica, J. istri*; and 'quatrième groupe' of *J. hopeana*. Veuille's grouping implicitly recognises the existence of the subgenus *Metajaera*, as well as further plausible divisions of the genus.

Veuille (1979) also suggests that *Iais* and *Jaera* share a close relationship. The phylogenetic analysis of the janirid genera (Wilson 1994) corroborates this hypothesis. Moreover, *Jaera* and *Iais* share, at least in *Jaera hopeana*, the habit of holding mancas with a specialised pereopod IV, a possibly useful synapomorphy. Franke (1993) provides a detailed description of this manca precopula and general mating behaviour for *J. hopeana*. *Jaera*, *Iais* and possibly others could be grouped under the available family name Jaeridae Stebbing (1905), once a phylogenetically based division of the Janiridae is determined.

Janaira Moreira & Pires, 1977*b*

Janaira Moreira and Pires, 1977*b*: 23.

Type species: *Janaira gracilis* Moreira & Pires, 1977*b*. Monotypic.

Other References

Janaira.—Moreira and Pires, 1977*a*: 181; Pires, 1981*b*: 31; Müller, 1989: 207.

Diagnosis

Body not especially broad, with of all tergites subequal. Cephalon broad, laterally quadrate; vertex anteriorly rounded, lacking rostrum; eyes dorsal, well developed. Pereonal tergites laterally rounded, coxae visible in dorsal view. Pleonite 1 short, narrower than pereon or pleon. Pleotelson somewhat narrower than pereonite 7, laterally rounded, lacking spines or denticles, with only slight notch at insertions of uropods. Antennula basal article longer than broad, only slightly broader than second article; flagellum with 7 articles. Antenna basal 4 articles subequal, article 3 with tiny scale; articles 5–6 elongate, much longer than basal articles 1–4; flagellum elongate, multiarticulate, having more than 30 articles, basal articles narrower than article 6, wider than long but not conjoint. Mandibles normal with truncate molar process and elongate palp, distal article curved and setose. Maxillipedal endite longer than broad, narrower than broad palp; palp articles 4–5 thin, straight-sided, narrower than palp articles 1–3; palp article 3 much wider than long, subrectangular. Pereopod I of male carpus enlarged, oval, with 2 rows of spine-like sensory setae; pereopod I in female similar to posterior walking legs; propodus of both sexes with row of spine-like sensory setae. Pereopods II–VII dactylus with 2 large subequal distal claws and third large subdistal accessory claw. Male pleopod I distal tip with medial lobes straight, angling smoothly into posteriorly pointed lateral lobes; lateral lobes curling medially only slightly. Male pleopod II endopod basal article around same width as maximum width of stylet; stylet of male pleopod II much shorter than sympod; not elongate or coiled. Female pleopod II with distinct distal notch. Pleopod III endopod with 3 equally spaced plumose setae; exopod of both sexes narrower than and same length as endopod; exopod uniarticulate, distally rounded, lacking plumose setae. Uropods large, longer than pleotelson, with narrow rami longer than propodus; exopod inserting apically; protopod much longer than wide.

Remarks

Janaira is very similar to *Janira*, *Carpias* and *Janiropsis*. It differs from *Janira* by having broad maxillipedal palp articles 2–3, and a male first pleopod that is not distally bifurcate.

Janaira has no laterally protruding lateral lobes on the male pleopod I and the male pereopod I is not elongate as in *Ianiropsis* or *Carpias*. Despite the claims of Moreira and Pires (1977*b*) to the contrary, *Janira* **does** have three claws on the walking legs as does *Janaira*, and the fourth pleopods of both genera are very similar. As the membership of some species in *Janira* is in doubt (especially *Janira operculata* Wolff, 1962), the type of the genus, *Janira maculosa* Leach, should be used for comparison with possibly new groups. The differences that remain between *Janaira* and *Janira* are subtle, and may not be sufficiently significant for a genus-level division. Nevertheless, *Janaira* should be retained until *Janira* is completely revised.

Janira Leach, 1814

Janira Leach, 1814: 434.
Oniscodes Berthold, 1828: 282.
Oniscoda Latreille, 1829: 140.
Henopomus Krøyer, 1849: 366.
Asellodes Stimpson, 1853: 41.
Ianira Meinert, 1877: 78.

Type species: *Janira maculosa* Leach, 1814.

Species Included

Janira maculosa Leach, 1814: 434 (possible senior synonym of *Ianira hanseni* Menzies, 1962*a*: 181); *Asellodes alta* Stimpson, 1853: 41; *J. japonica* Richardson, 1909: 114; *J. denticulata* Gourret, 1891: 34.

Other References

Janira.—Leach, 1815: 373; Rathke, 1843: 24; Dana, 1852: 716; Bate and Westwood, 1868: 338; Harger, 1879: 158; 1880: 321; Sars, 1883: 16, 64; Beddard, 1886*a*: 105; 1886*b*: 6; Norman, 1894: 280; Richardson, 1900: 300; 1901: 556; 1905*a*: 468; Rathbun, 1905: 44; Zirwas, 1910: 92; Dahl, 1916: 30; Monod, 1925: 241; Fee, 1927: 21; Nierstrasz and Stekhoven, 1930: 117; Gurjanova, 1932: 23; 1933: 399; Dons, 1935: 43; Hult, 1941: 40; Stephensen, 1943: 37; Hatch, 1947: 171; Stephensen, 1948: 74; Holthuis, 1949: 178; 1950: 13; 1952: 75; 1956: 107; Staiger and Bocquet, 1956: 4; Menzies, 1962*b*: 70; Barnard, 1962: 244; Wolff, 1962: 39–43, 233–5, 277, 281, 289, 293, 300; Gruner, 1965: 122; Miller, 1968: 23; Schultz, 1969: 259; Carvacho, 1981: 131; Kussakin, 1988: 116.

Asellodes.—Verrill, 1873: 437; Verrill, 1874*a*: 411, 502; 1874*b*: 350.

Bagatus.—Monod, 1974: 1123.

Henopomus.—Delage, 1881: 155.

Ianira.—Bovallius, 1886: 24; Hansen, 1888: 190; 1916: 13; Sars, 1897*a*: 98; Nierstrasz, 1941: 282; Hurley, 1961: 262.

Oniscoda.—Milne-Edwards, 1840: 151.

Diagnosis

Body broadest at pereonites 4–5. Cephalon broad, with rounded lateral margins lacking large spines; eyes dorsal; vertex anteriorly rounded or with small rostrum. Pereonites 2–4 laterally concave, coxae visible in dorsal view between reduced lappets. Pleonite 1 short, narrower than pereonite 7 or pleon. Pleotelson broad, near same width as pereonite 7, laterally rounded, with small row of denticles on posterolateral margins; slight notch for insertions of uropods. Antennula basal article longer than broad, only slightly broader than second article; flagellum with more than 20 articles. Antenna basal articles 1–4 subequal, article 3 with distinct scale; articles 5–6 elongate, longer than basal articles 1–4; flagellum multiarticulate, with more than 30 articles, basal articles length subequal to or greater than width, articles not swollen or conjoint. Mandibles normal with truncate molar process; palp elongate, distal article slightly curved and setose. Maxillipedal endite longer than wide, width subequal to palp; palp articles 4–5 narrow, straight-sided, distinctly narrower than broad articles 1–3, palp article 3 distally broad, setose, not tapering, near width of article 2.

Pereopod I carpus of male enlarged, oval, with 2 rows of spine-like sensory setae; propodus with fine denticles and spine-like sensory setae on ventral margin; pereopod I of female leg-like. Pereopod II of male elongated, distinctly longer than pereopods I or III, and distinctly longer than pereopod II of female. Pereopods II–VII dactylus with 2 large subequal distal claws and third large subdistal accessory claw. Male pleopod I distal tip with distinctly separated medial and lateral lobes; lateral lobes curling medially. Male pleopod II endopodal basal article not enlarged, approximately same width as widest part of stylet; stylet not coiled, shorter than sympod. Female pleopod II rounded with slight notch on distal margin. Pleopod III endopod either with 3 equally spaced plumose setae or with distinct gap between distal seta and 2 lateral setae; exopod of both sexes narrower than endopod and same length as or longer than endopod; exopod uniarticulate, distally pointed, lacking plumose setae. Uropods large, with narrow rami and propodus; endopod inserting apically; protopod subequal to endopod.

Remarks

The diagnosis of *Janira* is based on the type species, *Janira maculosa* Leach, and includes features that separate it from other similar genera such as *Ianiropsis* or *Carpias*. Females of *J. maculosa* are essentially similar to those of *Ianiropsis* and *Carpias*. In these genera, the definitive genus-level characters are found on the adult males. Sexual dimorphism also is present in at least *J. maculosa*. Although the male first pereopod is only slightly larger than that of the female, the second pereopod is decidedly larger than pereopod III. In females, both pereopods are approximately the same size. Assuming this difference holds for other species of *Janira*, the enlarged male pereopod II is a useful synapomorphy of this genus. Field workers should be aware that fully mature males are required to apply a genus name to a species collection of typical janirids.

As can be seen from the synonymies of other janirids, many species were originally included in *Janira*. Wolff (1962: 41–2) began the process of removing many species to other genera, whose changes we recognise here. Carvacho's (1981) review, which generally followed that of Wolff (1962), included several species in *Janira* that belong elsewhere. *Janira hirsuta* Carvacho, 1981, *J. capensis* Barnard, 1914, *J. tristani* Beddard, 1886*a* and *Ianiropsis bisbidens* Barnard, 1955 all belong in *Iathrippa* (see above). *J. tricornis* (Krøyer, 1849) belongs in *Janiralata*. *J. biunguicula* Hooker, 1985, a species with an atypically broad rostrum, was described only briefly, although a comparison of this species with *Microjanira dentifrons* Schiecke & Fresi, 1970 shows that they are congeneric. *J. biunguicula* Hooker, therefore, is moved to *Microjanira*. The only known specimen of a deep-sea species from the Gulf of Panama, *J. operculata* Wolff, 1962, lacks the cephalon and the male pleopods; therefore, its generic position cannot be established at present. *J. abyssicola* Beddard, 1886*a* is an unfigured dubious species (Wolff 1962); this species should be genus *incertae sedis* until the types are redescribed. Wolff's (1962) synonymy of *J. maculosa* and *J. hanseni* (Menzies, 1962*a*) is provisionally accepted, although the study of variation in this species should be extended beyond the inspection of coloration and the male pleopods. Vanhöffen (1914) included a *Janira* sp. with little description; this species lacks dorsally visible coxal epimera, making its assignment to *Janira* unlikely. Nierstrasz (1941) mentions *J. monodi*, erroneously attributed to Nordenstam, although this species must be a *nomen nudum* because a careful literature search for this species has found no source (in agreement with Wolff 1962). In addition to the type species, we recognise the following species as belonging to *Janira*: *J. alta* (Stimpson, 1853), *J. japonica* Richardson, 1909, *J. denticulata* Gourret, 1891. *J. alta* has a rostrum of possibly varying lengths (Hansen 1916; Kussakin 1988), unlike *J. maculosa* (see Wolff 1962). *J. japonica* Richardson, 1909 has not been reviewed since being described with only two simple drawings. Monod (1925) suggested that *J. denticulata* Gourret, 1891 from the Gulf of Marseille may be identical with the Nordic species *J. maculosa*. *J. denticulata* has been overlooked by later authors. These actions limit the definition of *Janira* to those species with 3 claws on the walking legs, although the species remaining in the genus will need careful revision to establish the above assertions with certainty. It is ironic that the type genus of the Janiridae is so poorly known.

Janiralata Menzies, 1951*b*

Janiralata Menzies, 1951*b*: 124.
Janirata Nunomura, 1991: 37–8.

Type species: *Janiralata davisi* Menzies, 1951*b*.

Species Included

J. abberrantis Kussakin & Mezhov, 1979: 163; *J. bifurcata* Mezhov, 1981: 11; *J. bilobata* Kussakin & Mezhov, 1979: 158; *J. bisinuata* Kussakin, 1972: 156; *Iolella chuni* Thielemann, 1910: 72; *J. davisi* Menzies, 1951*b*: 124; *Ianthe erostrata* Richardson, 1899: 858; *J. gurjanovae* Kussakin, 1962: 25; *J. hexadentata* Birstein, 1970: 294; *Tole holmesi* Richardson, 1905*a*: 216; *J. intermedia* Mezhov, 1981: 43; *J. koreaensis* Jang, 1991: 64; *J. kurilensis* Kussakin, 1962: 31; *J. microphthalma* Kussakin, 1972: 159; *J. modesta* Mezhov, 1981: 16; *J. obliterata* Kussakin, 1972: 162; *Janira occidentalis* Walker, 1898: 280; *J. ochotensis* Kussakin, 1962: 28; *J. pilosa* Kussakin, 1962: 34; *J. problematica* Kussakin & Mezhov, 1979: 166; *Janira pulchra* Hansen, 1916: 19; *J. rajata* Menzies, 1951*b*: 128; *J. rhacuraeformis* Birstein, 1963*a*: 17; *Iolella sarsi* Richardson, 1905*a*: 467; *J. serrata* Birstein, 1963: 12; *J. shiinoi* Kussakin, 1962: 28; *Janira solasteri* Hatch, 1947: 172; *Janira soldatovi* Gurjanova, 1933: 81; *Ianthe triangulata* Richardson, 1899: 857; *Henopomus tricornis* Krøyer, 1849: 372; *J. vitjazi* Kussakin, 1962: 32.

Other References

Janiralata.—Menzies, 1952: 119; Menzies and Barnard, 1959: 11; Kussakin, 1988: 25; Wolff, 1962: 41, 234–5, 254, 277, 291, 297; Miller, 1968: 24; Schultz, 1969: 265; Brandt, 1993: 130.

Janira.—Hansen, 1916: 17.

Ianthe.—Richardson, 1899: 857; 1900: 299.

Ianthopsis.—Wolff, 1962: 41; Brandt, 1991: 224.

Jolanthe.—Ortmann, 1900: 39–40 (*nomen nudum*).

Iolella.—Richardson, 1905*b*: 462; Nierstrasz, 1941: 283.

Janira.—Richardson, 1905*b*: 472; Stafford, 1913: 183; Boone, 1920: 7; Stephensen, 1943: 37; Gurjanova, 1950: 281; Wolff, 1962: 41, 254; Schultz, 1969: 259–60.

Janthe.—Stephensen, 1913: 70.

Jolella.—Oldevig, 1917: 42.

Tole.—Ortmann, 1901: 157.

Diagnosis

Body broad and flattened. Cephalon with dorsal eyes; lateral margins straight, with anterolateral points or spines; vertex obtusely pointed to rostrate. Lateral margins of pereonites 2–3 divided into 2 lobes by a deep cleft or a broad niche, coxae visible on dorsal view; pereonite 1 with coxal lappet dorsally visible in anterolateral border; coxae visible dorsally on posterior margins of pereonites 4–7, if at all. Pleonite 1 very short, only barely visible, much narrower than pereonite 7 or pleotelson. Pleotelson of varying outline, generally broad, near width of pereonite 7; usually with notch at insertions of uropod and denticles on lateral margins. Antennulae multiarticulate, with approximately 12–20 flagellar articles; antennal article 1 longer than wide. Antenna article 3 with conspicuous scale (exopod); basal articles 1–4 subequal or article 3 somewhat more robust than other basal articles; articles 5–6 long, distinctly longer than basal articles 1–4; flagellum multiarticulate, with more than 20 articles; basal articles of flagellum wider than long but not conjoint. Mandibular molar process truncate; palp long, article 3 elongate, curved and setose. Maxillipedal endite longer than wide, width subequal to palp; palp articles 4–5 narrow, straight-sided, distinctly narrower than broad articles 1–3, palp article 3 distally broad, setose, not tapering, near width of article 2. Pereopod I carposubchelate, dactylus short, with 2 claws; propodus on proximal inferior border serrated, carpus with 2 rows of short spine-like setae on ventral margin. Pereopod II–VII dactylus with 2 subequal claws, with subdistal accessory seta, sometimes enlarged into third claw. Male pleopod I distal tips

laterally expanded, with projecting subtriangular lateral lobes, and broad setose medial lobes merging smoothly into lateral lobes. Male pleopod II distal tip of protopod blunt, setiferous; basal article of endopod only somewhat wider than maximum stylet width, but not inflated; stylet elongate, curved, longer than sympod. Female pleopod II broad, ovate, distally with median concavity. Pleopod III endopod with 3 plumose setae having distinct gap between medial seta and 2 lateral setae; exopod narrower and longer than endopod; exopod with 2 segments, with distal plumose setae. Uropods biramous, rami subequal; exopod inserting apically; sympod about as long as rami.

Remarks on the 'Janiralata' Complex

Janiralata Menzies, 1951*b*, is the most heterogeneous genus of the 'Janiridae'. A majority of its species have been described from the northern Pacific Ocean, primarily owing to the taxonomic efforts of Kussakin and his coworkers (see Kussakin 1988). According to Menzies (1952), the characteristic feature is the serrated proximoventral margin of the propodus of the first pereopod. This structure is unique to *Janiralata* and is its primary defining synapomorphy of the various forms included below. In *Janira*, serrations occur at the same place, but they are finer and extend over the whole propodus.

Besides the single feature used by Menzies, some further common structures are present: the carpus of the first pereopod is elongate and oval, bearing an irregular row of sensory spine-like setae near the edge of the ventral margin on both sides. This type of carpus is also found in *Janira*, *Ianiropsis* and *Iathrippa*. The first coxa has an anterolaterally directed lobe visible in dorsal view and often shaped as the tergal lobe of the same segment. The sympod of the second male pleopod is broad and rectangular.

The species of *Janiralata* partly resemble *Iathrippa*, *Ianiropsis* or *Tole* (senior synonym of *Iolella*). *Janiralata* may not be a monophyletic unit and some species-groups may be related to *Tole* or the Acanthaspidiidae. This genus requires a careful revision to define genera and possibly families. The similarities of some species with *Iathrippa* deserve some comment: *Iathrippa* has, as do many species of *Janiralata*, a protruding rostrum, coxae that are visible in dorsal view, a first pereopod with two rows of sensory spine-like setae on the carpus. The serrations on the propodus are not present in *Iathrippa*. In comparison with *Janiralata*, *Iathrippa* has a more plesiomorphic, broad third pleopod and astonishingly small first male pleopods, thus clearly differing from *Janiralata*.

In the following, *Janiralata* is limited to groups of species. All species-groups have pairs of lateral tergal lappets on the pereonites 2 and 3, which enclose the coxae (see Wägele, 1989: his fig. 40). As already mentioned, the lobe of the first coxa is similar in shape to the tergal lobe. All coxae have a ventrolateral notch, which in some species deepens to two separate coxal lobes on pereopods II–IV. This morphology can be derived from the structures already present in *Janira*, *Iathrippa*, or *Ianiropsis* by enlargement of the tergal and coxal lobes. Only in the *rajata*-group (see below) are the coxae similar to those of *Janira*. Whether this situation is plesiomorphic or a secondary acquisition by reduction cannot be decided.

(A) The *rajata*-group has a dorsal outline similar to that of *Ianiropsis*; i.e. compared with *Iathrippa*, the rostrum is reduced. Pereopod I and the male pleopod II show the typical features of *Janiralata*. Lateral coxal and tergal margins are formed as in *Iathrippa*. The pleotelson is distally rounded.

The following species belong to this group:

J. koreaensis Jang, 1991
J. microphthalma Kussakin, 1972
J. modesta Mezhov, 1981
J. obliterata Kussakin, 1972
J. rajata Menzies, 1951*b*

(B) The *tricornis*-group. Here the rostrum is present (very acute in *J. tricornis*), the pleotelson is broader than in the foregoing group and the distal margin has shallow concavities above the insertion of the uropods. The species are:

J. erostrata (Richardson, 1899)
J. kurilensis Kussakin, 1962
J. pulchra (Hansen, 1916)
J. soldatovi (Gurjanova, 1933)
J. tricornis (Krøyer, 1849)
J. vitjazi Kussakin, 1962

Iolella alascensis Richardson, 1905*b* and *Tole libbeyi* Ortmann, 1901 are junior synonyms of *J. tricornis* (see Kussakin 1988).

(C) The following species have a broad pleotelson with posterolateral points, a concave distal telsonic margin medial to the points, and a small convex medial apex. The uropods insert in the concave areas. A short rostrum can be present or reduced.

(C.1) In this subgroup (*solasteri*-group) the rostrum is present, but it does not surpass the anterolateral point of the cephalon. The lateral tergal lappets are well developed (exception: *J. intermedia*). The species are:

J. bisinuata Kussakin, 1972
J. intermedia Mezhov, 1981
J. occidentalis (Walker, 1898)
J. pilosa Kussakin, 1962
J. solasteri (Hatch, 1947)
(?) *J. triangulata* Richardson, 1899

A species described by Richardson (1905*b*) as '*Iolella sarsi*', which is not identical with *Iathrippa sarsi* (Pfeffer, 1887), may also belong to this group.

(C.2) The *bifurcata*-group. The tergal lappets are clearly longer than wide, the coxae of pereopods II–IV also have pairs of long lateral lobes. The group includes those species having a cephalon with a blunt anterolateral horn-like spine in the species

J. holmesi (Richardson, 1905b)
J. bifurcata Mezhov, 1981

and those with two anterolateral horns in the species

J. bilobata Kussakin & Mezhov, 1979
J. problematica Kussakin & Mezhov, 1979

J. problematica has the same shape as found in the genus *Rhacura* Richardson, 1908. In *Rhacura*, only the outline of the body has been illustrated, and Richardson's (1908) description lacks the information that would allow a taxonomic assessment of their relationships (see *Rhacura* section below).

(D) The following species bear plumose setae on the exopod of pleopod III, and the pair of lateral coxal lobes on pereopods II–IV have an anterior lobe that is twice as long as the posterior.

(D.1) The *gurjanovae*-group. Without rostrum, pleotelson distally much narrower than proximally, with two apical notches above the insertion of the uropods. The species are:

J. gurjanovae Kussakin, 1962
J. ochotensis Kussakin, 1962
J. serrata Birstein, 1963*a*

(D.2) The *davisi*-group. Rostrum small or absent, coxae not visible in dorsal view, lateral tergal lappets broadened, pleotelson wider than long, distally rounded. Much of the diagnosis above was derived using *J. davisi* (type species of the genus!). The species are:

J. davisi Menzies, 1951*b*
J. chuni Thielemann, 1910

The genus *Janthura* Wolff, 1962 has the same body form as does *Janiralata davisi*. The genus contains deep-sea species [*Janthura abyssicola* Wolff, 1962, *J. bougainvillei* (Birstein, 1963*a*)] which are more specialised than *Janiralata davisi*: eyes lacking, the molar

process acute, the exopod of pleopod 3 with no setae (plesiomorphic state?). Nevertheless, *Janthura* could be closely related to *J. davisi*, because the broad tergal lappets are present on pereonites 2 and 3.

(D.3) The *hexadentata*-group. The following species have three pairs of tergal lappets instead of two as in the former groups, the third pair is present on the fourth pereonite. The rostrum is longer than in *J. tricornis*, the margin of the pleotelson has four lateral points and, between these, shallow concavities. In dorsal view only one coxal lobe is visible. The species are:

J. rhacuraeformis Birstein, 1963*a*
J. hexadentata Birstein, 1970
J. aberrantis Kussakin & Mezhov, 1979.

The group D.3 is very similar to *Tole* Ortmann. The latter only lacks the lateral points on the pleotelson, and the outline of the pleotelson is more similar to the species of group D.1. Furthermore, *Tole* bears dorsal spines on the tergites and has no plumose setae on the exopod of pleopod III. *Tole* shares the typical feature of group D, namely three pairs of tergal lappets and coxae that insert more ventrally than in other species of *Janiralata*; the coxae have small or reduced caudal lateral lobes. Group D could as well be the sister group of the Acanthaspidiidae, which have three pairs of lappets and plumose setae on the exopod of pleopod III.

The unusual polymorphism of the genus *Janiralata* can be explained partly with the parallel migration into deep water observed in some of the species-groups. Shallow-water species such as *J. rajata* (group A), *J. solasteri* (C.1), *J. gurjanovae* (D.1) or *J. davisi* (D.2) have a smooth outline of the body and larger eyes. Species from deep water can be recognised by their longer tergal and coxal lobes, with variation in the telson shape (especially in the groups D.1 and D.3). *Janiralata* species possibly have a common origin within the more primitive 'Janiridae', possibly providing a link to deep-sea families that have a morphology similar to *Tole*.

Janthura Wolff, 1962

Janthura Wolff, 1962: 45.
Austroniscoides Birstein, 1963*b*: 828.

Type species: *Janthura abyssicola* Wolff, 1962.

Species Included

J. abyssicola Wolff, 1962: 46; *Austroniscoides bougainvillei* Birstein, 1963*b*: 828.

Other References

Janthura.—Wolff, 1962: 34, 40, 236, 279, 281, 290; Menzies and George, 1972: 95; Siebenaller and Hessler, 1977: 18.

Diagnosis

Body broad and flattened, all pereonites width subequal. Cephalon lateral margins nearly straight, tapering anteriorly, setose, lacking spines; vertex broadly concave, not rostrate; eyes absent. Lateral margins of pereonites 2–3 divided into 2 lobes by cleft; lateral margin of pereonite 1 bilobed, consisting of coxal and pereonal lappet; coxae not visible in dorsal view on other pereonites. Pleonite 1 short, much narrower than pereonites or pleon. Pleotelson wider than long, narrower than pereonites; margins sinuate above insertions of uropods, lacking denticles or spines. Antennula short, with few articles; article 1 more or less tubular, length decidedly greater than width, tapering distally; flagellum with 3 articles. Antennal basal articles 1–4 subequal, article 3 bearing scale; articles 5 and 6 longer than basal articles 1–4; flagellum with greater than 20 articles, proximal articles separate and longer than wide, not swollen or conjoint. Mandibular molar process reduced, tapering distally with few setae; incisor process slender; palp longer than body of mandible, distal

article elongate, slightly curved, setose. Maxillipedal endite narrow, narrower than second joint of palp; palp articles 4–5 broad, near width of endite, marginally curved; palp article 3 short, distally tapering, narrower than broad articles 1–2. Pereopod I leg-like; carpus rectangular, lacking spine-like sensory setae; propodus slender, lacking spine-like sensory setae; dactylus short. Pereopod II–VII dactylus with only 2 distal claws, ventral claw distinctly smaller than dorsal claw; dactylus lacking accessory seta. Male pleopod I lateral lobe pointing laterally; medial lobe expanded, rounded. Male pleopod II sympod broad; endopod elongate, longer than protopod, curved, styliform; proximal article of endopod inflated, distinctly broader than stylet. Female pleopod II rounded with small rounded protrusion distally. Pleopod III endopod with 3 plumose setae having distinct gap between medial seta and 2 lateral setae; exopod width subequal to endopod, length greater than endopod, distally rounded, with 2 segments, lacking distal plumose setae, articulation between segments of exopod laterally indented, proximal article of exopod with distinct posterolateral lobe. Uropods elongate, longer than pleotelson, with thick sympods; exopod inserting apically, length near endopod length; sympod distinctly shorter than rami. Uropods biramous, branches elongate, subsimilar.

Remarks

Janthura is similar in body form to some species of *Janiralata* (see discussion of the *Janiralata davisi* group above). Species of *Janthura*, however, have specialised mouth parts and an unusually elongate stylet on the male pleopod II. The last feature is seen also in *Neojaera*, *Ectias* and *Heterias*. Menzies and George (1972) assigned *Austroniscus bougainvillei* Birstein, 1963*b* to *Janthura*; Siebenaller and Hessler (1977), who revised the Nannoniscidae, agreed with this synonymy. This genus is known only from the deep sea with a depth range of 2250–9034 m.

Mackinia Matsumoto, 1956

Mackinia Matsumoto, 1956: 1219.

Type Species: *Mackinia japonica* Matsumoto, 1956.

Species Included

M. birsteini Henry & Magniez, 1991: 223; *M. continentalis* Birstein & Ljovushkin, 1965*b*: 1006; *M. coreana* Matsumoto, 1967; *M. japonica dilatata* Matsumoto, 1967; *M. japonica japonica* Matsumoto, 1956: 1219; *M. troglodytes* Matsumoto, 1967.

Other References

Mackinia.—Birstein, 1961: 137; Wolff, 1962: 36, 38, 236, 250, 276, 281, 290; Coineau, 1986: 468.

Diagnosis

Body elongate, flattened, more than 4× longer than broad, pereonite widths subequal or slightly broadening posteriorly. Cephalon lateral margins rounded, lacking spines; vertex concave, lacking rostrum; eyes absent. Lateral margins of pereonites rounded, without lappets, coxae not visible in dorsal view. Pleonite 1 short, narrower than pereonite 7 or pleon. Pleotelson ovate, narrower than pereonite 7 but width subequal to pereonite 1 width; margins rounded, not denticulate, lacking notches near uropods. Antennula short, flagellum with 4 articles; article 1 more or less tubular, length decidedly greater than width. Antennal basal articles 1–4 length subequal, article 3 with scale; articles 5 and 6 longer than basal articles 1–4; flagellum with more than 20 articles; proximal articles separate and longer than wide, not conjoint or swollen. Mandibular molar process thin, parallel-sided, distally truncate, with broad grinding surface; palp large, longer than body of mandible, distal article curved and setose. Maxillipedal endite longer than wide, narrower than palp; palp articles 4–5 narrow, straight-sided; palp article 3 distally tapering, basally near width of palp article 2. Pereopod I leg-like, as slender as pereopods 2–7, carpus elongate, with few

spine-like setae; propodus with spine-like setae; dactylus short. Pereopod II–VII dactylus with only 2 distal claws and no accessory seta, ventral claw distinctly smaller than dorsal claw. Male pleopod I lateral lobe reduced, stopping at lateral margin of medial lobes; medial lobes produced posteriorly, distally semicircular. Male pleopod II sympod distally produced, rounded; proximal article of endopod broader than maximum width of stylet but not inflated or rounded; stylet shorter than protopod, thin, with distinct angle in distal part. Female pleopod II rounded with slightly concave distal tip. Pleopod III endopod lacking plumose setae; exopod broader and longer than endopod; exopod broadly rounded distally, with 2 segments, lacking plumose setae. Uropods biramous, longer than or subequal to pleotelson; exopod shorter than endopod, inserting proximal to apex; sympod elongate, subequal to endopod.

Remarks

This dwarfish janiroidean has been excluded from the Microparasellidae because it lacks an enlarged pleonite 1 (see below) and the mandible still conserves a grinding surface on the molar process. It was once classified in the now disused Microjanirinae Birstein, 1961. Most differences in *Mackinia* species from more typical janirids are simply reductions for the interstitial habit. *Mackinia* might be related to *Heterias*: their body forms are somewhat similar and their pleopods lack plumose setae. The phylogenetic analysis of the janirid group (Wilson 1994) supports some relationship between these two genera. This genus is currently known only from fresh ground-waters of Japan, Korea and the far east of Russia.

Microjaera Bocquet & Lévi, 1955

Microjaera Bocquet and Lévi, 1955: 118.

Type species: *Microjaera anisopoda* Bocquet & Lévi, 1955. Monotypic.

Other References

Microjaera.—Spooner, 1959*a*: 1696; Birstein, 1961: 137; Wolff, 1962: 35, 38, 277, 281, 290; Naylor, 1972: 60; Schiecke, 1973: 152; Coineau, 1986: 468; Kussakin, 1988: 183.

Diagnosis

Dwarfish isopods; body about 6× longer than wide, width of all pereonites subequal. Cephalon quadrate, lateral margin straight-sided, lacking spines; eyes absent; bases of antennulae separated by short broadly rounded rostral process. Pereonites laterally rounded or straight-sided, lacking spines or lappets; coxae not visible in dorsal view. Pleonite 1 short, only somewhat narrower than pereonite 7 or pleotelson. Pleotelson ovate, narrower than pereonite 7, with a terminal spine-like process, margins lacking denticles or notches near uropods. Antennula short, flagellum with 2 articles; article 1 more or less tubular, length greater than width, shorter than article 2. Antennal basal articles (1–4) all subequal, article 3 lacking scale; articles 5 and 6 longer than basal article; flagellum with 12 short articles, proximal articles wider than long, near width of article 6 but not conjoint and swollen. Mandibular molar process without grinding surface, distally tapering to rounded setose tip; lacinia mobilis on left mandible conspicuous; palp shorter than body of mandible but still functional; distal article of palp curved and setose. Maxillipedal endite longer than wide, narrower than article 2 of palp; palp articles 1-3 enlarged; article 4 long, narrow, straight-sided; article 5 much shorter than long article 4; article 3 broad, not distally tapering. Pereopod I stouter than pereopods II–VII but still leg-like; carpus with few spine-like setae; dactylus short, with 2 unequal claws, dorsal claw as long as dactylus. Pereopod II–VII dactylus with only 2 distal claws, ventral claw near same size as dorsal claw. Male pleopod I lateral lobes elongated into copulatory horns; medial lobes distally flattened, merging directly into lateral lobes. Male pleopod II sympod oval; stylet very slender, long, curved, much longer than sympod (basal article of endopod not described). Female operculum broad, distal margin broad, slightly concave. Pleopod III endopod with only single medial plumose seta; exopod narrower than endopod, length subequal to endopod

length, uniarticulate. Uropods biramous, endopod 3 × longer than exopod; exopod inserting apically; sympod shorter than exopod, not visible in dorsal view.

Remarks

A terminal spine on the pleotelson is a useful autapomorphy of *Microjaera anisopoda*. Otherwise this species is similar to the other diminutive interstitial janirids that lack the more extreme characteristics of the Microparasellidae. The broadly rounded rostrum on the head appears in other taxa, such as *Xostylus* or *Caecianiropsis*, although the details of its form are uncertain. *Microjaera* is most similar to *Caecianiropsis* in antennal form, body form, and possibly in the male second pleopods, although the last character is poorly illustrated in this species.

Microjanira Schiecke & Fresi, 1970

Microjanira Schiecke and Fresi, 1970: 243.

Type species: *Microjanira dentifrons* Schiecke & Fresi, 1970.

Species Included

M. dentifrons Schiecke & Fresi, 1970: 243; *Janira biunguicula* Hooker, 1985: 268.

Other References

Microjanira.—Schiecke, 1973: 149; Coineau, 1986: 468.

Diagnosis

Dwarfish isopods, body flattened, roughly elliptical, somewhat less than 3 × longer than wide. Cephalon laterally rounded with broadly pointed anterolateral margin lacking denticles; apex with long and broad, apically truncate rostral projection separating bases of antennulae; eyes absent or dorsolateral with few ocelli. Pereonites 2–4 laterally rounded or concave; coxae on all pereonites visible in dorsal view. Pleonite 1 very short, narrower than pereonite 7 or pleotelson. Pleotelson ovate, distal margin rounded, margin lacking denticles or notch near uropods. Antennula short; article 1 enlarged, length near width; flagellum with 3–4 articles. Antennal basal articles (1–4) lengths subequal; article 3 with scale; articles 5 and 6 longer than basal articles 1–4; flagellum probably multiarticulate, proximal articles separate, longer than wide. Mandibular molar process distally tapering, truncate; incisor process and body of mandible slender; palp large, near length of mandibular body, distal article strongly curved and setose. Maxillipedal endite longer than wide, narrower than palp; palp article 2 of maxillipedal palp expanded, much broader than articles 1 or 3; articles 4–5 thin, straight-sided; article 3 tapering distally, distinctly narrower than article 2. Pereopod I leg-like, with thin, elongate carpus lacking spine-like sensory setae, dactylus short. Pereopod II–VII dactylus with only 2 distal claws, ventral claw smaller than dorsal claw; accessory seta absent. Male pleopod I distally truncate, not laterally expanded; medial lobes setose and rounded; lateral lobes merged into medial lobes. Male pleopod II sympod distally tapering; proximal article of endopod near maximum width of stylet; stylet shorter than protopod, distal tip narrows abruptly to thin point. Pleopod III endopod broader than exopod, length subequal to exopod, distal tip rounded with 3 plumose setae, with gap between medial seta and lateral 2 plumose setae. Uropods thin, shorter than length of pleotelson; sympod slender, nearly as long as exopod; exopod shorter than endopod, inserting apically on sympod.

Remarks

The cephalon of *Microjanira* is *Austrofilius*-like, although the thin, somewhat elongate uropods of this genus set the two taxa apart. As discussed above, *Janira biunguicula* Hooker, 1985 also belongs in *Microjanira*. The family Microjaniridae Birstein, 1961 is a *nomen nudum* because *Microjanira* was not described until 1970, and the proposed family included only the genera *Microjaera*, *Caecianiropsis*, *Protocharon* and *Mackinia*. If this

genus is moved to a new family grouping not included in one of the recognised families, the reviser will have the choice of using some name other than 'Microjaniridae' if desired (recommended).

Neojaera Nordenstam, 1933

Neojaera Nordenstam, 1933: 188.
Ianisera Kensley, 1976: 299.

Type species: *Jaera antarctica* Pfeffer, 1887.

Species Included

Jaera antarctica Pfeffer, 1887: 94; *Neojaera caeca* Kussakin & Vasina, 1984: 12; *N. elongata* Menzies, 1962*b*: 74; *Ianisera expansa* Kensley, 1984*a*: 275; *N. hirsuta* Sivertsen & Holthuis, 1980: 107; *Jaera octodentata* Vanhöffen, 1914: 529; *?Austrofilius pallidus* Kussakin, 1982: 82; *Jaera pusilla* Barnard, 1925: 404; *Jaera serrata* Barnard, 1914: 433; *Ianisera trepidus* Kensley, 1976: 299.

Other References

Neojaera.—Kesselyák, 1938: 221, 247; Nierstrasz, 1941: 287; Wolff, 1962: 234, 235, 277, 294, 300; Kussakin, 1967: 306, 340; Monod, 1974: 1133; Arnaud, 1974: 562, 646; Schultz, 1976: 24; Siebenaller and Hessler, 1977: 20.
Ianisera.—Branch *et al.*, 1991: 28.
Jaera.—Nordenstam, 1930: 550.

Diagnosis

Body flattened, elongate, at least 3·5× longer than wide. Cephalon anterior margin rounded or sinuate, lacking rostrum so that bases of antennulae not separate medially; eyes small and dorsal, sometimes absent; lateral margins often denticulate with anterior points. Pleonite 1 narrower than pleotelson or anterior pereonites. Pleotelson narrower than anterior pereonites, lateral margin often with denticles; posterior margin slightly sinuate above insertion of uropods. Antennula article 1 broad, wider than long, with anteromedial lobe, flagellum with 2–3 articles. Antenna with scale (exopod), flagellum with 20 or more articles, proximal articles longer than broad, not conjoint. Mandibular molar process truncate with broad grinding surface; palp near length of mandibular body, distal article curved and setose. Maxillipedal endite length subequal to width, width subequal or broader than palp, palp articles 1–3 expanded, about as broad as endite; article 3 not tapering; palp article 4 straight-sided; palp article 5 shorter than article 4, rounded. Pereopod I leg-like; carpus elongated, rectangular, with no spine-like setae; propodus slender, with spine-like setae; dactylus short with 2 claws. Pereopods II–VII dactyli with 2 distal claws, ventral claw smaller than dorsal claw; accessory seta absent. Male pleopod I medial lobes rounded; lateral lobes sometimes prolonged; proximal region of pleopod I extremely broad and rounded, not straight. Male pleopod II with exopod inserting subapically on sympod; endopod with long, often coiled slender stylet and greatly expanded proximal article. Female pleopod II outline circular. Pleopod III endopod with 3 plumose setae having distinct gap between medial seta and 2 lateral setae; exopod narrower than and around same length as endopod; exopod with 2 segments, lacking plumose setae. Uropods short, biramous, often emerging from notches in pleotelson; protopod short, squat, shorter than rami; exopod inserting apically.

Remarks

See *Austrofilius* (above) for part of the remarks for this genus. We regard *Neojaera* to be fairly heterogeneous because it contains both broad and thin forms. All species seem to have distinctive male pleopods: pleopod I expanded and rounded laterally; and pleopod II with a narrow protopod, an inflated proximal article of the protopod and an extremely long, coiled stylet. Some characters also are found in *Austrofilius* and *Caecianiropsis*, but the

absence of a rostrum makes *Neojaera* distinct. *Ianisera* Kensley, 1976 was later suggested by Kensley (1984*c*) to be congeneric with *Neojaera* although no name changes were made. A comparison of published descriptions of both taxa shows that this synonymy is indeed valid. In fact, *Ianisera trepidus* Kensley is similar to *N. antarctica* (Pfeffer) as described by Vanhöffen (1914). More recently, Kensley (in Branch *et al.* 1991) continued to use the name *Ianisera*. Further study of the type specimens is probably needed. Kussakin (1982) described *Austrofilius pallidus* as lacking a rostrum; this species therefore is a *Neojaera*. *N. caeca* Kussakin & Vasina (1984) has decidedly *Janiralata*-like characteristics, although the crude drawing of the male pleopods indicates that this species should be classified in *Neojaera*.

Protocharon Chappuis, Delamare-Deboutteville & Paulian, 1956

Protocharon Chappuis, Delamare-Deboutteville and Paulian, 1956: 58.
Jehaia Wagner, 1990: 187.

Type species: *Protocharon arenicola* Chappuis, Delamare-Deboutteville & Paulian, 1956.

Species Included

Protocharon arenicola Chappuis, Delamare-Deboutteville & Paulian, 1956: 58; *Jehaia stocki* Wagner, 1990: 187.

Other References

Protocharon.—Chappuis and Delamare-Deboutteville, 1960: 354; Birstein, 1961: 137; Wolff, 1962: 35, 38, 250, 276, 281, 290; Schiecke and Fresi, 1970: 249; Monod, 1975: 1010; Coineau, 1986: 472.

Diagnosis

Tiny isopods about 4× longer than wide, all pereonites subequal width. Cephalon rounded, lacking rostrum, vertex straight; eyes reduced to tiny dorsal spots. Pleonite 1 short or not visible. Pleotelson ovate, lateral margins denticulate, distal margin truncate, width subequal to pereonites width; uropods inserting directly on posterior margin. Antennula first article broad, longer than wide; flagellum with 3–4 articles. Antennal [known only in *P. stocki*] basal article 1 fused or absent; articles 2–3 more than twice as broad as distal articles; article 3 with short antennal scale; articles 5–6 shorter than article 3, flagelliform; flagellum with 8 articles. Mandibular molar process thin, distally rounded and setose, without grinding surface; mandibular body slender; palp elongate, distal article slightly curved with few distal setae. Maxilliped endite much broader than palp, distally quadrate with row of large rounded setulose setae (modified fan setae); palp slender, all segments longer than wide, widths subequal. All pereopods similarly slender; dactyli with 2 claws, ventral claw near same size as dorsal claw. Male pleopod I tapering posteriorly; medial lobe on distal tip projecting and rounded, paucisetose; lateral lobe rounded, protruding only slightly from margin of pleopod. Sympod of male pleopod II broad, laterally oval, tapering distally, stylet much shorter than sympod. Female operculum broad, subcircular or oval. Pleopod III narrow, distally rounded, endopod lacking plumose setae; exopod narrower and longer than endopod; exopod uniarticulate, distally rounded, lacking plumose setae. Pleopod VI rudimentary and pleopod V absent [in *P. stocki*]. Uropods near length of pleotelson, or shorter; sympod near length of endopod; exopod shorter, inserting subapically on sympod.

Remarks

This tiny freshwater janirid genus has previously been placed either in the Janiridae (Wolff 1962) or the Microjaniridae (Birstein 1961); this is discussed further with respect to the Microparasellidae below. *Protocharon* is possibly related to *Mackinia*. The concept of *Protocharon* is here restricted to *P. arenicola* and *P. stocki* because *Protocharon antarctica* Chappuis, 1958 has different mouth parts, and should not be in the same genus. Wagner (1990) erected the new genus *Jehaia* because he believed that the differences in chaetotaxy

of the antennae, the free pleonite 1 and outline of the uropods are substantially different from *Protocharon*. The synapomorphic similarities of the antennae, the mouthparts and the male pleopod I in both taxa argues for their monophyly. Consequently, we here subsume *Jehaia* under *Protocharon*.

Taking a cue from Coineau (1986, footnote on p. 472), we re-inspected the original description of *Protocharon antarctica*. Typical of many interstitial workers' papers, Chappuis did not illustrate the whole animal, providing only a scattered selection of rather poor limb illustrations. His illustrations, however, reveal mouth parts that are clearly similar to those of *Iais aquilei* and *I. chilense*, and unlike those of *P. arenicola*. Although Chappuis (1958) states that the pereopods have only two claws, his illustration of pereopod VII in the species *antarctica* appears to have an over-large terminal seta, unlike any found on most janirids; this could be the tip of a subterminal third accessory seta or claw. Furthermore, he notes that the pereopod IV of the male displays some secondary sexual differences (Chappuis, 1958: 18). *Iais aquilei* also has dimorphic pereopods IV: in the male, it is shorter than the other pereopods, and it lacks the subdistal third claw (Chappuis *et al.* 1956); the fourth pereopod of the females resembles its neighbours. This dimorphism may be a synapomorphy of the *Iais* group. Therefore, we remove *Protocharon antarctica* to *Iais*, pending a thorough revision of *Protocharon* and all species of *Iais*. The species *Austrofilius arnaudi* (genus *incertae sedis*) may be related to *Protocharon* or *Iais*, as suggested in the *Austrofilius* discussion, but some illustrated features of *A. arnaudi* conflict with the published figures of *P. arenicola*.

Protocharon has enlarged fan setae on the distal tip of the maxillipedal endite, which also apparently occurs in *Iais* (e.g. *I. aquilei* Coineau, 1977). These maxillipedal setae cannot be used as a diagnostic character because the endite is poorly illustrated in most groups. The similarity of body form between *Iais* and *Protocharon* is at least suggestive of a relationship, although the two genera have differing numbers of claws on the pereopods and rather different mouthparts overall.

Family **MICROPARASELLIDAE** Karaman, 1934

Provisional Diagnosis

Tiny janiroideans with slender body, pleonite 1 free and width subsimilar to pereonites; all somites approximately same width. Eyes and chromatophores absent. Flagellum of antennula with maximally 4 articles. Mandibular molar process distally pointed, without grinding surface, with several terminal setae. First pereopod similar to walking legs, without subchela. Pereopods II–VII with 3 dactylar claws, accessory seta or claw 3 often reduced or absent. Pleopod III endopod with 3 plumose setae (often reduced or absent), exopod slender. Exopods of uropods, when present, inserting subapically on sympod. Anus terminal, not covered by pleopods.

History and Composition of the Microparasellidae

The family Microparasellidae was erected by Karaman (1934) to include the genera *Microparasellus* Karaman, 1933 and *Microcharon* Karaman, 1934. The family is characterised by free first pleonites, eyes absent, a short first antenna, a second antenna shorter than the body, furnished with a scale on article 3, and pereopods with two claws.

Wolff (1962) compared features of this family with those of other slender janiroideans, namely the Thambematidae Stebbing, 1912 and the Microjanirinae Bocquet & Lévi, 1955. The Thambematidae are a specialised group of deep-sea isopods with only one large claw on pereopods II–VII and with no closer affinities to the Janiridae. The status of the Thambematidae as a separate family is generally accepted (see also Harrison 1987). The Microjanirinae have two claws, a subcylindrical molar process, a slightly differentiated or undifferentiated first pereopod and a male pleopod I which is narrower at its base.

Birstein (1961) accepted this division with the Microjanirinae as a separate family containing the genera *Microjaera*, *Caecianiropsis*, *Protocharon* and *Mackinia*. Wolff (1962), on the other hand, believes that the Microjanirinae and Microparasellidae cannot be

separated from the Janiridae, arguing that their defining features are reductions and adaptations to the interstitial habitat that might evolve independently several times in different taxa. The common features, reduction of the eyes and the slender body, are not enough to define the families. Kussakin (1988) follows Wolff (1962) in not recognising the Microparasellidae.

This criticism is in conformity with the requirements necessary to obtain a phylogenetic system, but the Janiridae cannot be defined as a monophyletic family (Wilson 1994). Therefore, monophyletic groups of genera within the 'Janiridae' should be sought. The Microparasellidae possibly are such a group. The genera to be discussed in this context are *Angeliera* Chappuis & Delamare-Deboutteville, 1952, *Caecianiropsis* Menzies & Pettit, 1956, *Mackinia* Matsumoto, 1956, *Microcharon* Karaman, 1934, *Microjaera* Bocquet & Lévi, 1955, *Microparasellus* Karaman, 1933, *Paracharon* Coineau, 1968, and *Protocharon* Chappuis *et al.*, 1956.

Since Wolff's (1962) comments, the discussion of the validity of the family Microparasellidae has been controversial (see Coineau 1986). Of the above-mentioned genera only *Angeliera*, *Microcharon*, *Microparasellus*, *Paracharon* and *Protocharon* are usually kept as microparasellids (Coineau and Schmidt 1979; Coineau 1986). With the exception of *Protocharon*, a freshwater genus with broader posterior pereonites that should not be included in the Microparasellidae, these animals are more slender than any 'janirid', the free pleonite being relatively long in comparison with the pereonites, all somites having the same width. A useful apomorphy is the subapical insertion of the exopod on the sympod of the uropods. Additional apomorphies also occur in other 'Janiridae': the antennular flagellum has fewer than four articles, the third pleopod exopod is slender, and the molar process is pointed and has no grinding surface. The eyes and chromatophores are reduced, although these are almost certainly of little phylogenetic value because of the almost universal reduction of these features in interstitial and hypogean animals. Symplesiomorphies are the short dactylus with three claws (third claw only retained in *Angeliera*), anus terminal, not covered by pleopods.

The body outline of *Microparasellus* varies with respect to other microparasellids: the lateral borders of the tergites are rounded and slightly protruding, bearing numerous small cuticular scales, and cephalon and pleotelson are shorter than in the remaining microparasellids. Furthermore, the uropods of *Microparasellus* are reduced and the exopod is absent. The family concept of the Microparasellidae may be open to challenge because *Microparasellus* is distinct from the other three genera in these autapomorphies. *Angeliera*, *Paracharon* and *Microcharon* all have their pereopodal insertions rotated dorsally—unlike *Microparasellus*. Characteristic autapomorphies of the other genera are: the maxillipedal palp of *Angeliera* has only four articles, the sympod of uropods is expanded in *Microcharon*. Moreover, Just and Poore (1992) note *Angeliera* with male penes attached to the coxae and the male pleopods being at variance with what is expected for janiroideans. *Microcharon* also has coxal penes (see generic section below). Although we continue to recognise a reduced concept of the Microparasellidae, the composition of this family will require further study.

Zoogeographic data (summary in Coineau 1986) do not help to understand the origin of the Microparasellidae because this family has a world-wide distribution, especially around the area of the ancient Tethys. A freshwater origin is not probable, and the dwarfish freshwater genus *Protocharon* should be excluded as a model for the ancestor of the microparasellids. Stock (1977) suggested that the freshwater microparasellids were 'stranded' during the Miocene sea-level regressions, and subsequently became adapted to hyposaline conditions. Species of *Angeliera* live mesopsammally in sandy beaches and sublittoral interstitial biotas, *Microcharon* is known from sandy beaches, some freshwater species are stygobiontic in Mediterranean karst areas. *Microparasellus* is known from perimediterranean ground water, and *Paracharon* is known only from beaches of New Caledonia. Wägele (1990) discusses the distribution of the microparasellids further.

With the above-mentioned apomorphies to define the family, the hypothetical ancestor of the group belongs to those janiroideans that had a short dactylus with three terminal claws on the pereopods II–VII, and the exopod of pleopod III with three plumose setae.

Protocharon and *Mackinia* do not have these plumose setae, similar to *Angeliera*. *Caecianiropsis* and *Microjaera*, which also show adaptations to the interstitial habitat, have only two claws, the body is broader and the free pleonite much shorter than in most microparasellids, the antennae are separated by a broad rostrum, the propodus of pereopod I bears sensory spine-like setae, and in *Caecianiropsis* the molar process is not acute. Therefore, the following genera may form a monophyletic group, for which the name Microparasellidae is available: *Angeliera*, *Microcharon*, *Microparasellus* and *Paracharon*. This hypothesis will need further evaluation as the evolutionary relationships of the Asellota become better known.

Genera of the Microparasellidae

Angeliera Chappuis & Delamare-Deboutteville, 1952

Angeliera Chappuis and Delamare-Deboutteville, 1952: 2014.
Brevipleonida Gnanamuthu, 1954: 258.

Type species: *Angeliera phreaticola* Chappuis & Delamare-Deboutteville, 1952.

Species Included

A. cosettae Coineau & Rao, 1972; *A. dubitans* Stock, 1977: 69; *Brevipleonida gracilis* Gnanamuthu, 1954: 258; *A. ischiensis* Schulz, 1954: 253; *A. phreaticola* Chappuis & Delamare-Deboutteville, 1952: 2014; *A. psamathus* Kensley, 1984*a*: 64; *A. racovitzai* Coineau & Botosaneanu, 1973: 196; *A. rivularis* Stock, 1985: 92; *A. xarifae* Siewing, 1959: 365.

Other References

Angeliera.—Chappuis and Delamare-Deboutteville, 1954: 123; Chappuis and Delamare-Deboutteville, 1960: 321; Birstein, 1961: 137; Wolff, 1962: 35, 38, 236, 250, 276, 281, 289, 291, 300; Coineau and Renaud-Mornant, 1977: 346; Renaud-Mornant and Coineau, 1978: 1249; Coineau, 1981: 20; Coineau, 1986: 468–9; Kensley and Schotte, 1989: 91.

Diagnosis

Dwarfish slender isopods, body 7–10× longer than broad. Cephalon anteriorly broader than posteriorly; lateral margin straight, lacking lateral spines or plate-like extensions; vertex straight, without rostrum, frontal margin medially compressed; eyes absent. Pereonal tergites dorsally reduced; pereopods inserting dorsolaterally. Pleonite 1 enlarged, width subequal to pleotelson width. Pleotelson longer than broad, nearly rectangular in dorsal view, lateral margins lacking denticles. Antennula short; article 1 more or less tubular, longer than wide; flagellum with 4 articles. Antenna longer than antennula; article 3 enlarged compared with articles 1–2 and 4, without scale; articles 5 and 6 length subequal to article 3; flagellum usually with 8 articles, proximal articles separate and longer than wide. Mandible molar process without grinding surface, distally pointed; palp with strongly curved distal article. Maxillipedal endite longer than wide, narrow at insertion of palp and broadening distally; palp much narrower than endite, with only 4 articles, distal article pointed, proximal article longest. Maxillipedal palp slender, with 4 articles, distal article with sickle-shaped tip; endite broad, distally rectangular. All pereopods similarly slender, with 3 claws. Pereopod I leg-like; carpus slender, margins slightly curving, with few spine-like setae; propodus without spine-like setae. Pereopods II–VII with 3 distal claws on dactyli, ventral distal claw smaller than dorsal claw. Pereopod V of male carposubchelate. Male pleopod I with distally rounded medial lobes, sometimes laterally expanded; lateral lobes reduced, confluent with lateral margin. Male pleopod II sympod not broad, subrectangular; proximal article of endopod near maximum width of stylet; stylet distally very slender, shorter than sympod. Pleopod III if present lacking exopod; endopod small, rounded, lacking setae. Female operculum distally bilobed, with median incision. Uropods inserting terminally, large sympods broader than rami; exopod shorter than endopod, inserting subterminally on sympod.

Remarks

Angeliera has the morphology of a typical mesopsammal isopod, with a slender body, dorsolateral insertions of the pereopods, reduced eyes. The uropodal sympod is enlarged, the exopod inserts subapically. Three dactylar claws are present, and the first pereopod bears no subchela. A peculiar feature is the outline of the fourth (last) palp article of the maxilliped, which ends with a sickle-shaped apex. The species are known from sandy marine beaches.

Just and Poore (1992) report that a species of *Angeliera* from Australia retains the primitive isopod configuration of the male penes attached directly to the coxae. Specimens of *Microcharon* in the U.S. National Museum of Natural History were also found to have coxal penes. The presence of coxal penes has important implications for the eventual placement of the Microparasellidae among the Asellota, and may require a new rearrangement of the families of the Asellota that is at odds with the current superfamily scheme. An alternative hypothesis, as suggested in the character analysis of janirid taxa (Wilson 1994), is that the coxal position of the penes might be a reversion owing to the repositioning of the coxae. The homology of this feature in *Angeliera* and *Microcharon* obviously requires further consideration.

Microcharon Karaman, 1934

Microparasellus Karaman, 1933: 20.
Microcharon Karaman, 1934: 44.
Duslenia Lévi, 1950: 42.

Type species: *Microparasellus stygius* Karaman, 1933.

Species Included (see 'Other References' for page numbers)

M. acherontis Chappuis, 1942; *M. anatolicus* Pesce & Galassi, 1990; *M. angelicae* Pesce & Galassi, 1988*b*; *M. angelieri* Coineau, 1963*a*; *M. antonellae* Galassi, 1991; *M. apolloniacus* Cvetkov, 1964; *M. arganoi* Pesce & Tetè, 1981 [cited in Coineau, 1986]; *M. boui* Coineau, 1968; *M. bureschi* Cvetkov, 1976; *M. coineauae* Galhano, 1970; *M. comasi* Coineau, 1985 [*nomen nudum* cited in Coineau, 1986: 469]; *M. doueti* Coineau, 1968; *M. eurydices* Cvetkov, 1965; *M. galapagoensis* Coineau & Schmidt, 1979; *M. halophilus* Birstein & Ljovushkin, 1965*b*; *M. harrisi* Spooner, 1959*b*; *M. heimi* Coineau, 1968; *M. hercegovinensis* Karaman, 1959; *M. herrerai* Stock, 1977; *M. hispanicus* Pesce & Galassi, 1988*a*; *M. juberthiei juberthiei* Coineau, 1968; *M. juberthiei ramosus* Coineau, 1968; *M. karamani* Pesce & Tetè, 1978*b*; *M. kirghisicus* Jankowskaja, 1964; *M. latus latus* Karaman, 1933; *M. latus prespensis* Karaman, 1954; *M. letiziae* Pesce & Galassi, 1988*b*; *M. longistylus* Pesce & Galassi, 1988*b*; *M. luciae* Sket, 1990 ; *M. lydicus* Pesce & Galassi, 1990; *M. major* Karaman, 1954; *M. margalefi* Sabater & de Manuel, 1988; *M. marinus* Chappuis & Delamare-Deboutteville, 1954; *M.* cf. *marinus* Pesce & Galassi, 1988*a*; *M. meijersae* Pesce & Galassi, 1988*a*; *M. monnioti* Bocquet, 1970; *M. mooreanensis* Coineau [*nomen nudum* cited in Coineau, 1986: 472]; *M. motasi* Serban, 1964; *M. notenboomi* Pesce & Galassi, 1988*a*; *M. nuragicus* Pesce & Galassi, 1988*b*; *M. oltenicus* Serban, 1964; *M. orghidani* Serban, 1964; *M. orphei* Cvetkov, 1977; *M. othrys* Argano & Pesce, 1979; *M. phlegetonis* Cvetkov, 1967; *M. phreaticus* Coineau & Botosaneanu, 1973; *M. profundalis beranensis* Karaman, 1940; *M. profundalis kosovensis* Karaman, 1940; *M. profundalis kumanovensis* Karaman, 1940; *M. profundalis profundalis* Karaman, 1940; *M. raffaellae* Pesce, 1979; *M. reginae* Dole & Coineau, 1987; *M. rouchi* Coineau, 1968; *M. sabulum* Kensley, 1984*a*; *M. salvati* Coineau, 1968; *M. silverii* Pesce & Galassi, 1988*b*; *M. sisiphus* Chappuis & Delamare-Deboutteville, 1954; *Microparasellus stygius* Karaman, 1933; *M. stygius hellenae* Chappuis & Delamare-Deboutteville, 1954; *M. tantalus* Birstein & Ljovushkin, 1965*b*; *M. teissieri* Lévi, 1950; *M. thracicus* Cvetkov, 1965; *M. ullae* Pesce, 1981; *M. zibani* Pesce & Tetè, 1978*a*; *M.* sp. Pesce & Galassi, 1988*a*; *M.* sp. Schotte, Heard & Kensley, 1991.

Other References

Microcharon.—Karaman, 1940: 33; Chappuis, 1942: 120; 1944: 6; Birstein, 1951: 129; Lévi, 1950: 42–7; Birstein, 1952: 227; Chappuis and Delamare-Deboutteville, 1954: 111; Karaman, 1954: 108; 1958: 11; 1959: 333; Spooner, 1959*a*: 1696; 1959*b*: 58; Delamare-Deboutteville, 1960: 295; Chappuis and Delamare-Deboutteville, 1960: 301; Birstein, 1961: 137; Wolff, 1962: 35, 38–9, 276, 281, 290; Coineau, 1963*a*: 711; 1963*b*: 197; Serban, 1964: 342; Coineau, 1968: 146; Wells, 1963: 85; Cvetkov, 1964: 201; Jankovskaja, 1964: 975; Birstein and Ljovushkin, 1965*b*: 1001; Cvetkov, 1965: 312; Galhano, 1966: 11; Cvetkov, 1968: 108; Galhano, 1970: 83; Bocquet, 1970: 85; Cōineau and Botosaneanu, 1973: 191; Cvetkov, 1976: 81; 1977: 70; Stock, 1977: 70; Pesce and Tetè, 1978*a*: 992; 1978*b*: 116; Coineau and Schmidt, 1979: 145; Pesce and Argano, 1979: 129; Argano and Pesce, 1979: 178; Argano, 1979: 36; Coineau, 1981: 20; Pesce, 1979: 237; 1981: 58; Kensley, 1984*b*: 66; Coineau, 1986: 469–71; Dole and Coineau, 1987: 200; Kussakin, 1988: 179; Kensley and Schotte, 1989: 91; Pesce and Galassi, 1988*a*: 308; 1988*b*: 250; 1990: 173; Sket, 1990: 41; Galassi *et al.*, 1990: 265; Galassi, 1991: 201; Schotte *et al.*, 1991: 254; Coineau, 1992: 101.

Diagnosis

Dwarfish, slender isopods; body more than 7× longer than broad, all somites of subequal width. Cephalon anteriorly broader than posteriorly; lateral margin straight, lacking lateral spines or plate-like extensions; vertex straight, without rostrum, frontal margin medially compressed; eyes absent. Pereonal tergites dorsally reduced; pereopods inserting dorsolaterally. Pleonite 1 enlarged, width subequal to pleotelson width. Pleotelson longer than broad, longer than any pereonite, nearly rectangular in dorsal view, lateral margins lacking denticles. Antennula short; article 1 more or less tubular, longer than wide; flagellum with 2–3 articles. Antenna longer than antennula; article 3 enlarged compared with articles 1–2 and 4, with scale; length of articles 5 and 6 subequal to article 3; flagellum with 8–12 articles, proximal articles separate and longer than wide. Mandibular molar process without grinding surface, distally pointed; palp with strongly curved distal article. Maxillipedal palp broader than endite, articles 2–3 slightly expanded. Pereopod I leg-like; carpus slender, margins straight, with few or no spine-like setae; propodus without spine-like setae. Pereopods II–VII with 2 distal claws on dactyli, accessory seta absent. Penes inserting on coxa of pereopod VII. Male pleopod I with distally rounded medial lobes, never expanded; lateral lobes reduced, confluent with lateral margin; sperm channel open groove, not closed tube. Male pleopod II sympod broadly oval; proximal article of endopod near maximum width of stylet; stylet distally very slender, shorter than sympod. Female pleopod II operculum oval or rectangular, distal margin sometimes with median concavity. Pleopod III endopod plumose setae if present with distinct gap between medial seta and 2 lateral setae; exopod narrower than and around same length as endopod; exopod pointed, with 2 segments, lacking plumose setae. Uropods with conspicuously long and broad sympods, inserting terminally on pleotelson; both rami short and slender, exopod inserting subapically.

Remarks

Species of *Microcharon* have a body form similar to *Angeliera*, but the maxillipedal palp is not modified and has five articles. The sympod of the uropods is usually larger and longer than in *Angeliera*. Only two dactylar claws are present. The species are found in sandy beaches, at low depth in marine sand and in phreatic water (Coineau 1986). Like *Angeliera*, *Microcharon* also has penes on the coxae of pereopod VII (observations of *M. acherontis* Chappuis, 1942, U.S. National Museum of Natural History, cat. no. 855509), a significant fact for future revisions of the Microparasellidae (see above under *Angeliera*).

Microparasellus Karaman, 1933

Microparasellus Karaman, 1933: 17.

Type species: *Microparasellus puteanus* Karaman, 1933.

Species Included

M. aloufi Coineau, 1978 [cited in Coineau 1986: 149]; *M. hellenicus* Argano & Pesce, 1979: 173; *M. libanicus* Chappuis & Delamare-Deboutteville, 1954: 108; *M. puteanus* Karaman, 1933: 18.

Other References

Microparasellus.—Karaman, 1940: 39; 1954: 107; Chappuis and Delamare-Deboutteville, 1960: 295; Birstein, 1961: 137; Wolff, 1962: 35, 38, 250, 276, 281, 290; Coineau, 1968: 149; Coineau, 1986: 471–2.

Diagnosis

Dwarfish isopods, body 4–6× longer than wide. Cephalon lacking eyes; lateral margins rounded; vertex broadly angular but lacking rostrum. Tergites laterally protruding, margins straight or rounded with denticles; coxae not visible in dorsal view. Pleonite 1 enlarged, width subequal to pleotelson width. Pleotelson of varying outline, often oval, longer than wide, longer than any pereonite, lateral margins with denticles. Antennula short; article 1 subrectangular, longer than wide, with denticles; flagellum with 3–4 articles. Antenna short; article 3 enlarged compared with articles 1–2 and 4, lacking scale; articles 5–6 length subequal to article 3 length; flagellum with 7–8 articles, proximal articles separate and longer than wide. Mandibular molar process without grinding surface, pointed; palp short, near length of mandibular body, with truncate and slightly curved distal article. Maxilliped normal; endite longer than wide; palp with slightly expanded articles 2–3; endite about as broad as palp; palp article 3 subrectangular; palp articles 4–5 narrow, straight-sided. Pereopod I carpus long, cylindrical with 1 or no spine-like sensory setae; propodus lacking spine-like sensory setae; dactylus shorter than dorsal claw. Pereopods II–VII similarly slender, dactyli with only 2 distal claws, ventral claw distinctly smaller than dorsal claw, accessory seta absent. Male pleopod I with distally rounded medial lobes, never expanded; lateral lobes reduced, confluent with lateral margin; sperm channel ventrally closed, not open groove. Male pleopod II sympod broad, distally tapering; proximal article of endopod near maximum width of stylet; stylet distally very slender, shorter than sympod. Female pleopod II operculum broadly oval. Pleopod III endopod lacking plumose setae; exopod narrower and longer than endopod; exopod slender, with 2 segments, lacking plumose setae. Uropods short, squat, uniramous, inserting terminally on pleotelson; single ramus shorter than sympod.

Remarks

Microparasellus puteanus, the first discovered microparasellid (Karaman 1933), lives in phreatic water, as do all of the hitherto known species of the perimediterranean genus. In the same publication, Karaman (1933) described *M. stygius*, for which he later (1934) erected the genus *Microcharon*. The species of *Microparasellus*, whose morphology is not well known, have a broader body than other microparasellid genera, with laterally protruding tergites (see Coineau 1968, her fig. 1) bearing denticles. The uropods are very short and uniramous, the latter condition being found in no other 'janirid' or microparasellid genus.

Paracharon Coineau, 1968

Paracharon Coineau, 1968: 153.

Type species: *P. renaudae* Coineau, 1968. Monotypic.

Other References

Paracharon.—Coineau, 1970: 373; 1971: 29, 107; 1986: 472.

Diagnosis

Dwarfish isopods, body about 5–6× longer than wide. Cephalon and pleotelson longer than any of the pereonites. Cephalon lacking eyes; nearly rectangular in dorsal view; lateral margins rounded; vertex straight-sided, lacking rostrum or projection. Pereonites with coxal insertions dorsolateral, but with small tergal projection dorsally; coxae visible in dorsal view. Pleonite 1 short, narrower than pleotelson or pereonites. Pleotelson with rounded tip and shallow marginal grooves above insertion of uropods; lateral margins lacking denticles. Antennula short; article 1 more or less tubular, length greater than width; flagellum with 2 articles. Antenna short; article 3 enlarged compared with articles 1–2 and 4, with distinct scale (exopod); articles 5 and 6 short, subequal to articles 3; flagellum with 6 articles, proximal articles separate and longer than wide. Mandibular molar process without grinding surface; palp longer than body of mandible, with large slightly curved distal article. Maxilliped endite longer than wide, endite about as broad as palp; palp articles 2–3 slightly expanded, article 3 not tapering, palp articles 4–5 slender. Pereopod I leg-like; carpus slender, oval, lacking spine-like sensory setae; propodus lacking spine-like sensory setae; dactylus short, claws somewhat shorter than dactylus, enlarged and oval. Pereopods II–VII dactyli with only 2 distal claws, accessory seta absent, ventral claw subequal to dorsal claw. Penes on posteromedial margin of sternite, not on coxae of pereopods VII. Male pleopod I medial lobes rounded; lateral lobes short and hook-like. Male pleopod II sympod slender, laterally rounded, tapering distally; endopod proximal article near maximum width of stylet; stylet shorter than sympod. Female pleopod II operculum nearly quadrangular with rounded corners. Pleopod III endopod with 3 plumose setae having distinct gap between medial seta and 2 lateral setae; exopod narrower and longer than endopod; exopod distally pointed, with 2 segments, lacking plumose setae. Uropods long, inserting terminally on pleotelson; sympod about as long as endopod, exopod shorter, inserting subterminally on sympod.

Remarks

This monotypic genus is known only from New Caledonia. *Paracharon* is similar to *Microcharon*, but the coxae of pereopods are not fully visible in dorsal view, their insertion being more ventral than in *Microcharon*. The uropods are less broad than in *Microcharon*, and the pereonites less slender.

Janiroidea *incertae sedis*

Tole Ortmann, 1901

Ianthe Bovallius, 1881: 5.
Tole Ortmann, 1901: 157 (available misspelling of *Iole* nom. praeocc.).
Janthe Ortmann, 1901: 158.
Iolella Richardson, 1905*b*: 457.
Jolella Vanhöffen, 1914: 536 (not Richardson, 1905*b*).
Lanira Boone, 1920: 7.

Type species: *Janira spinosa* Harger, 1879.

Species Included

Iolella glabra Richardson, 1908: 71; *Janira laciniata* Sars, 1872: 92; *Janira spinosa* Harger 1879: 158 (senior synonym of *Ianthe speciosa* Bovallius, 1886: 34); *Ianthe spinosissima* Stephensen, 1936: 7; *Ianthe vilhelminae* Stephensen, 1913: 94.

Other References

Iolella.—Thielemann, 1910: 72; Nierstrasz, 1941: 283; Menzies, 1962*b*: 83; Wolff, 1962: 33, 39–40, 234–5, 277, 293, 300; Schultz, 1969: 251; Kussakin, 1988: 125; Wägele, 1989: 76.

Ianthe.—Richardson, 1900: 299; 1901: 555; Sars, 1897*a*: 101.

Janira.—Harger, 1880: 323; Stephensen, 1913: 68; Barnard, 1914: 436; Gurjanova, 1932: 23; Barnard, 1955: 6.

Ianira.—Hansen, 1888: 191; 1916: 20.

Diagnosis

Cephalon with a prominent acute rostral process nearly as long as remaining cephalon; pair of acute anterolateral projections directed anteriorly; eyes conspicuous dorsally. Body flattened; tergites with acute lateral projections: one on pereonite 1 directed anteriorly, pair on each side of pereonites 2–4, single caudally curved projections on each tergite 5–7. Pereonites often with sharp dorsal spines. Pleotelson with characteristic pair of posterolateral, pointed lappets; uropods inserting between these lappets. Antennula short, but with multiarticulated flagellum. Antenna with scale (exopod), peduncular articles 5–6 elongated; flagellum long, multiarticulated. Mandibular molar process with grinding surface of varying size. Maxillipedal palp articles 1–3 broader than 4–5, endite about as broad as palp. Pereopod I somewhat stouter than pereopods II–VII, carpus long-oval, with 1 row of acute sensillate setae on palm; dactylus very short, with 2 terminal claws. Pereopods II–VII slender, with 2 terminal claws; coxa, merus and dactylus short, other articles long-cylindrical. Tips of male pleopod I apically truncate. Sympod of male pleopod II distally narrower than proximally, endopod barely surpassing sympod. Pleopod III endopod with 3 plumose setae having distinct gap between medial seta and 2 lateral setae; exopod narrower and longer than endopod; exopod having 2 segments, lacking plumose setae. Female operculum nearly quadrangular, with rounded corners, distal margin with a shallow medial concavity. Uropods slender, elongated, sympod longer than rami.

Remarks

The type species of *Tole*, *Janira spinosa* Harger, 1879 (type locality: north of Cape Cod), was assigned to *Ianthe* (with *Ianthe speciosa*) by Bovallius, 1881 (type locality: Baffin Bay). *Tole* Ortmann, 1901 was proposed to replace the preoccupied name *Ianthe* Bovallius, 1881, which Ortmann (1901: 158) misspelled as *Janthe* in his list of species in his new genus *Tole*. In a letter to Richardson, Ortmann explained that *Iole* was the intended name in his 1901 publication, and that *Tole* was an error. Thus, Richardson (1905*b*: 457 footnote) created the genus *Iolella* to replace the preoccupied name *Iole*. Nevertheless, *Tole* is an available name (Neave 1939) and is a senior synonym of *Iolella*. *Tole* could be suppressed under the plenary powers of the Commission using the 50-year rule (ICZN article 79), but a prima facie case that stability is threatened cannot be made. *Iolella* has been used in only 8 different publications, some prior to 1943 (50 years preceding this writing). Moreover, corrections of commonly used generic names to little-used forms has been the rule in isopod taxonomy (e.g. *Jaeropsis* to *Joeropsis* Koehler in Sivertsen and Holthuis 1980), so we recommend that priority apply in this case. *Tole* replaces *Iolella* as the name of the taxon whose type species is *Ianthe speciosa* Bovallius. *T. speciosa* is a junior synonym of *T. spinosa* (synonymy proposed by Hansen 1916).

Tole was placed in the family Janiridae (as *Iolella*) by Wolff (1962), and in the Janirellidae by Menzies (1962*b*, spelled 'Ianirellidae'). *Tole* has some features in common with the *Janiralata* species-group D.3 (see above), namely the acute rostrum and the outline of the tergal lappets, but it differs from *Janiralata* in the lack of plumose setae on the exopod of pleopod 3. Furthermore, the lateral coxal lobes are shorter and barely visible in dorsal view. *Tole* also cannot be included in any of the lappet-bearing families as they are presently defined (Mictosomatidae, Mesosignidae, Acanthaspidiidae, Janirellidae, Katianiridae) because the species of *Tole* have three claws on the pereopods II–VII (in contrast to e.g. *Janirella*). Therefore, *Tole* should be considered *incertae sedis*.

The species *Janira exstans* Barnard, 1914 was included in *Iolella* by Wolff (1962: misspelled *J. extans*). An inspection of the original description, however, shows that this species is undoubtedly a santiid, perhaps in the genus *Santia*. The following species are assigned to the genus *Janiralata*: *Iolella alascensis* Richardson, 1905*b* [junior synonym of *J. tricornis* (Krøyer, 1849)]; *Ianthe erostrata* Richardson, 1899 (placed in *Janiralata* by Kussakin 1962); *Tole holmesi* Richardson, 1905*a*; *Iolella chuni* Thielemann, 1910; *Tole libbeyi* Ortmann, 1901 (junior synonym of *J. tricornis*); *Iolella sarsi* Richardson, 1905*b* (placed in *Janiralata* by Menzies 1951*b*); *Ianthe triangulata* Richardson, 1899. *Iolella* sp.

(Vanhöffen, 1914) might be a member of *Ianthopsis*. Kussakin (1988) provides thorough synonymies for most species in *Tole* and *Janiralata*, including many taxonomic decisions listed here.

Jaerella Richardson, 1911*b*

Jaerella Richardson, 1911*b*: 634.
Iaerella Nierstrasz, 1941: 285.

Type species: *Jaerella armata* Richardson, 1911*b*. Monotypic.

Other References

Jaerella.—Wolff, 1962: 34, 40, 236, 258, 278, 281, 291; Kussakin, 1988: 187.
Ianira.—Hansen, 1916: 13.

Diagnosis

Body broad, pereonite widths subequal. Cephalon with elongate anterolateral spines and lateral spines; eyes large, rounded, dorsally situated; vertex with elongate rostrum extending to tip of antennulae; pair of elongate dorsal spines between eyes. Pereonite 1 with single elongate lateral marginal spines and one pair of dorsal spines. Pereonites 2–7 lateral margins with 2 elongate lappet-like spines; each tergite with 2 dorsal spines except for pereonite 4 which has 4 dorsal spines. Pleonite 1 fused to pleotelson. Pleotelson broad, nearly as broad as pereonites, somewhat flattened, dorsally lobed; margins with single long posterior projecting lateral spines and pair of long terminal spines; uropods emerging from under concave posterior margin. Antennular flagellum with 10–11 articles. Antennal basal articles (1–4) all subequal; antennal articles 5 and 6 longer than basal articles 1–4; flagellum probably exceeding 12 articles, proximal articles separate and longer than wide, not conjoint or swollen. [Mouthparts not described or illustrated.] Pereopod I prehensile; pereopods II–VII ambulatory [claws not described]. [Pleopods not described.] Uropods not modified, reduced, distinctly shorter than pleotelson, with short protopod and slightly unequal rami; exopod inserting apically.

Remarks

Jaerella may be closely related to either *Ianthopsis* or *Rhacura*, but is too poorly described at the moment to allow an appropriate assignment. Unfortunately, the only type of the genus is a dried male specimen residing at the US National Museum of Natural History.

Rhacura Richardson, 1908

Rhacura Richardson, 1908: 73.

Type species: *Rhacura pulchra* Richardson, 1908. Monotypic.

Other References

Rhacura.—Menzies, 1962*a*: 171; Wolff, 1962: 34, 39, 236, 263, 279, 281, 290; Schultz, 1969: 253; Kussakin, 1988: 72.
Ianira.—Hansen, 1916: 13.

Diagnosis

Body broad, pereonites broadening posteriorly, all body margins with minute acute spinules. Cephalon lateral margin with 2 large subtriangular lateral spines; minute eyes situated dorsally near posterior margin of cephalon; rostrum absent, although vertex broadly triangular. Pereonites with broad triangular spines on lateral margins: 1 spine on pereonites 1 and 4; 2 spines on pereonites 2–3 and 5–6; 3 spines on pereonite 7. Pleonite 1 very short, narrower than pleotelson or pereonite 7. Pleotelson near width of anterior pereonites; lateral margins with 4 large broad subtriangular spines; posterior margin convex.

Antennular article 1 more or less tubular, length greater than width; flagellum with around 18 articles. Antennal basal articles 1–4 all subequal, article 3 with large scale [articles 5–6 and flagellum unknown]. [Mandible not described.] Maxillipedal endite longer than wide, width subequal to basal articles of palp; palp article 3 broad, quadrate, not tapering; palp articles 4–5 narrow, straight-sided. Pereopod I prehensile [not described further]. Pereopods II-VII ambulatory, dactyli with 2 claws [not described further]. [Pleopods unknown.] [Uropoda unknown, probably large.]

Remarks

Rhacura is another genus that would benefit from a complete revision. The type species, *R. pulchra*, was described as having minute eyes and only two claws on the pereopods, as well as multiple pointed lateral projections on the pleotelson and pereon. This genus seems to fall within the range of variation of *Ianthopsis*, which would indicate that *Rhacura* may be near the Acanthaspidiidae in affinities. Bowman (in litt: Wolff, 1962: 34) reports that *Rhacura* has coxal plates similar to that of *Janiralata*. In addition, *J. problematica* Kussakin & Mezhov, 1979 of the *Janiralata bifurcata* group (see above) has a dorsal outline nearly identical to that of *R. pulchra*. If these two species should be in the same genus, the concept of *Janiralata* should be revised to distinguish the two genera. Nevertheless, the uropods, pleopods, and mandible of the genus are unknown, and the dactylar claw count needs to be checked again. No further action should be taken until the genus is revised, perhaps after more specimens are found (only a single damaged specimen has been described). *Rhacura* was included tentatively by Menzies (1962*a*) in the Janirellidae, a conclusion not followed here.

Trichopleon Beddard, 1886*a*

Trichopleon Beddard, 1886*a*: 106.

Type species: *Trichopleon ramosum* Beddard, 1886. Monotypic.

Other References

Trichopleon.—Beddard, 1886*b*: 21; Wolff, 1962: 40, 236, 259, 274, 278, 281, 291.

Diagnosis

Body broad anteriorly, pereonites narrowing posteriorly; all body surfaces devoid of denticles or tubercles. Cephalon lateral margin without denticles or spines, slightly curved, tapering posteriorly; eyes completely absent; rostral area broad, rounded, sloping into frons. Pereonite tergites 1–4 laterally truncate, with anteriorly directed spine; pereonite 5–7 posteriorly directed, pereonite 5 laterally truncate, pereonites 6–7 laterally rounded. Pleonite 1 fused to pleotelson. Pleotelson narrower than pereonites, widest anteriorly, tapering posteriorly to distal spine; lateral margins smoothly curving, fringed with slender setae. Antennulae long; antennular article 1 broad, length greater than width, with small rounded lobe medially; flagellum with 16 articles. Antenna longer than body; article 3 slightly enlarged compared with basal articles 1–2 and 4, with distinct scale; articles 5 and 6 much longer than basal articles 1–4; flagellum with more than 30 articles; flagellar proximal articles separate and longer than wide, not conjoint or swollen. [Mandibles not described.] Maxillipedal endite wider than long, broader than palp; palp articles 1–3 broad; palp article 3 quadrate, not tapering; palp articles 4–5 elongate, straight-sided, much narrower than basal articles. Pereopod I leg-like, with elongate setae [but apparently no sensillate setae]. Pereopod II–VII dactyli with only 1 large distal claw, ventral claw [if present] much smaller than dorsal claw. [Pleopods unknown.] Uropods unmodified, shorter than pleotelson; exopod shorter than endopod, inserting apically; sympod elongate, subequal to rami.

Remarks

The only specimen of this blind, deep-water isopod genus (a preparatory female mounted in Canada balsam) was collected south of the Philippine Islands at 500 fathoms. More specimens and species will be needed for a complete redescription. In the descriptions of *Trichopleon*, Beddard (1886*a*, 1886*b*) reports features found in the janirids (large uropods, maxillipedal palp articles 4 and 5 narrow and elongate), as well in some deep-sea taxa (broad rostral area of cephalon, single-clawed dactyli). In addition, he illustrates some odd 'sculpturing' of the cuticle that may indicate that this animal has a thick opalescent cuticle like that of *Xostylus* and other deep-sea taxa. An inspection of the type specimen from the British Museum indicates that *Trichopleon* has a cephalon similar to *Xostylus*. As for *Xostylus* (see below), a proper family assignment for *Trichopleon* cannot be made at this time.

Xostylus Menzies, 1962*a*

Xostylus Menzies, 1962*a*: 179.

Type species: *Xostylus parallelus* Menzies, 1962*a*.

Species Included

X. parallelus Menzies, 1962*a*; *X. longiflagellus* Birstein, 1970: 297.

Other References

Xostylus.—Wolff, 1962: 63, 236, 263, 279, 281, 290; Kussakin, 1988: 165.

Diagnosis (based on *X. parallelus*)

Body narrow, straight-sided, all pereonites subequal. Cephalon lateral margin without denticles or spines, slightly curved, tapering posteriorly; eyes completely absent; rostral area broad, rounded, sloping into frons. Pereonites laterally rounded, coxae visible in dorsal view only on posterolateral margins of pereonites 5–7. Pleonite 1 short, only slightly narrower than pleotelson and pereonite 7. Pleotelson only slightly narrower than anterior pereonites; lateral margins smooth, lacking denticles or spines; uropods emerging posteriorly from slight notches in posterolateral margin; anus separated from pleopodal chamber. Antennular article 1 more or less tubular, length greater than width; flagellum with 5 articles [8 articles in *X. longiflagellatus*]. Antennal basal articles (1–4) subequal, article 3 bearing small rounded scale; articles 5 and 6 longer than basal articles 1–4; [flagellum unknown in *X. parallelus*]. Mandibular molar process slender, distally truncate; palp shorter than body of mandible, distal article short, curved, setose. Maxillipedal endite length subequal to width, width subequal to palp; palp articles 1-3 broad, article 3 quadrate, not tapering; palp articles 4–5 straight-sided, much narrower than basal articles 1–3. [Pereopod I unknown in *X. parallelus*.] Pereopod II–VII dactyli with only 2 distal claws, with ventral distinctly smaller than and closely adpressed to dorsal claw. [Pleopods and uropods unknown in *X. parallelus*.]

Remarks

Xostylus was originally classified by Menzies (1962*a*) in the Abyssianiridae (now synonymised with Paramunnidae, see Just 1990), although Wolff (1962) felt that it was more similar to the janirids *Ectias* Richardson or *Caecianiropsis* Menzies & Pettit. Neither grouping seems correct, as *Xostylus* has several characters that would ally it with several deep-sea families: an exposed anus completely separate from the branchial chamber and placed ventrally as in the Haploniscidae, Nannoniscidae, Desmosomatidae or Ischnomesidae (i.e. not an abyssianirid); a ventral dactylar claw distinctly smaller than the anterior claw (not a typical 'janirid' feature); and a pleopod III exopod that is short, laterally rounded,

fused into a single segment, and distally pointed, i.e. similar to that of the Nannoniscidae or the Haploniscidae and dissimilar to the 'janirid' condition. In addition, the cuticle of *Xostylus* spp. is heavily calcified as in many of the deep-sea forms. In many respects, this genus seems somewhat generalised; for example, an ischnomesid conceivably could be derived from a *Xostylus*-like ancestor.

The species *X. longiflagellus* Birstein, 1970 has features that are reminiscent of the coarse drawings of *Trichopleon*, especially in its long antennae and antennulae, serially similar pereopods, and anteriorly pointed pereonites 1–4. Moreover, *X. longiflagellus* also has several characters that are different from *X. parallelus*: its dactylar claws are more equal in size and separate, it has large anterolateral setae on the pereonites, the antennula is longer, and the mandibular molar process is distally bifurcate rather than truncate. For this reason, the diagnosis above was constructed without using *X. longiflagellus*. If *Trichopleon* were better known, possibly *X. longiflagellus* could be put in that genus. *Xostylus* and *Trichopleon* may belong to the same family-level taxon, perhaps related to one of the deep-sea families.

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References

Amar, R. (1950). Sur un *Bagatus* nouveau pour la faune Méditerranéenne française. *Bulletin de la Société Zoologique de France* **75**, 36–42.

Amar, R. (1952). Isopodes marins du littoral Corse. *Bulletin de la Société Zoologique de France* **77**, 349–55.

Amar, R., and Roman, M.-L. (1973). Invertébrés Marins des VIIème et XVème Expéditions Antarctiques Françaises en Terre Adélie. 14. Tanaidacés et Isopodes. *Tethys* **5**, 561–600.

Arcangeli, A. (1934). Il genere *Jaera* Leach nel mediterraneo e la convivenza occasionale di *Jaera hopeana* Costa con *Sphaeroma serratum* (Fabr.). *Bolletino Museo Zoologico di Torino* **44**, 273–92.

Argano, R. (1979). Isopodi (Crustacea Isopoda). *Guide per il Riconoscimento delle Specie Animali delle Acque Interne Italiane* **5**, 1–63.

Argano, R., and Pesce, G. C. (1979). Microparasellids from phreatic waters of Greece (Isopoda, Asellota). *Crustaceana* **37**, 173–83.

Arnaud, P. M. (1974). Contributions à la bionomie marine benthique des régions Antarctique et sub-antarctique. *Tethys* **6**, 467–653.

Bachman, A. (1964). Nota preliminar sobre la presencia de isópodes parasélidos en el delta del Paraná. *Physis* **24**, 491–2.

Barnard, K. H. (1914). Contributions to the crustacean fauna of South Africa. 3. Additions to the marine Isopoda with notes on some previously incompletely known species. *Annals of the South African Museum, Capetown* **10**, 325–442.

Barnard, K. H. (1920). Contributions to the crustacean fauna of South Africa. 6. Further additions to the list of marine Isopoda. *Annals of the South African Museum, Capetown* **17**, 319–438.

Barnard, K. H. (1925). Contributions to the crustacean fauna of South Africa. 9. Further additions to the list of Isopoda. *Annals of the South African Museum, Capetown* **20**, 381–412.

Barnard, K. H. (1927). A study of the freshwater isopodan and amphipodan Crustacea of South Africa. *Transactions of the Royal Society of South Africa* **14**, 139–215.

Barnard, K. H. (1940). Contribution to the crustacean fauna of South Africa. XII. Further additions to the Tanaidacea, Isopoda, and Amphipoda, together with keys for the identification of hitherto recorded marine and freshwater species. *Annals of the South African Museum, Capetown* **32**, 381–543.

Barnard, K. H. (1955). Additions to the fauna list of South African Crustacea and Pycnogonida. *Annals of the South African Museum, Capetown* **43**, 1–107.

Barnard, K. H. (1962). New records of marine Crustacea from the East African region. *Crustaceana* **3**, 239–45.

Barnard, K. H. (1965). Isopoda and Amphipoda collected by the Gough Island Scientific Survey. *Annals of the South African Museum, Capetown* **48**, 195–210.

Bate, C. S. (1865). Characters of new species of crustaceans discovered by J. K. Lord on the coast of Vancouver Island. *Proceedings of the Zoological Society of London* **1864**, 668.

Bate, C. S. (1866). (descriptions of Crustacea). In 'The Naturalist in Vancouver Island and British Columbia'. (Ed. J. K. Lord.) Vol. 2, Chapt. 13, pp. 265–84. (R. Bentley: London.)

Bate, C. S., and Westwood, J. O. (1861–1868). 'A History of the British Sessile-eyed Crustacea.' Vol. 2. (John Van Voorst: London.)

Beddard, F. E. (1886*a*). Preliminary notice of the Isopoda collected during the voyage of H.M.S. 'Challenger'. Part III. *Proceedings of the Zoological Society of London* **1886**, 97–122.

Beddard, F. E. (1886*b*). Report on the Isopoda collected by H.M.S. 'Challenger' during the years 1873–76. Part II. *Challenger Reports (Zoology)* **17**, 1–175.

Bellan-Santini, D. (1969). Contribution à l'études des peuplements infralittoraux sur substrat rocheux. *Recueils et Travaux de la Station marin d'Endoume* **63**, 9–294.

Berthold, O. (1828). 'Latreille's natürliche Familien des Thierreichs.'

Birstein, Y. A. (1951). 'Freshwater Isopods (Asellota).' Vol. 7 (Crustacea), No. 5. In Series 'Fauna of U.S.S.R', New series No. 47. (Series Eds E. N. Pavlovskii and A. A. Shtakel'berg.) (Zoological Institute of the Academy of Sciences of the USSR: Moscow/Leningrad.) (In Russian, English translation by Israel Program for Scientific Translations, Jerusalem, 1964.)

Birstein, Y. A. (1952). Some data on the origin of phreatic fauna. *Transactions of the Hydrobiological Association of the USSR* **4**, 225–9. (In Russian.)

Birstein, Y. A. (1961). *Microthambema tenuis* n. gen., n. sp. (Isopoda Asellota) and relations of some asellote isopods. *Crustaceana* **2**, 132–41.

Birstein, Y. A. (1963*a*). 'Deep Sea Isopod Crustaceans of the Northwestern Part of the Pacific Ocean.' (Institute of Oceanology, Academy of Sciences, USSR: Moscow.) (In Russian with English summary.)

Birstein, Y. A. (1963*b*). Isopods from the ultra-abyssal zone of the Bougainville Trench. *Russkii Zoologischeskii Zhurnal* **42**, 814–33. (In Russian.)

Birstein, Y. A. (1970). Additions to the fauna of Isopods (Crustacea, Isopoda) of the Kurile–Kamchatka Trench. Part I. In 'Fauna of the Kurile-Kamchakta Trench and its Environment'. (Ed. I. P. P. Schirshova.) *Academy of Sciences of the USSR, P.P. Shirshov Institute of Oceanology, Moscow* **86**, 292–340. (In Russian, English Translation by Israel Program for Scientific Translations, Jerusalem, 1972.)

Birstein, Y. A., and Ljovushkin, S. I. (1965*a*). Faune des eaux souterraines Saumâtres de l'Asie centrale. *International Journal of Speleology* **1**, 307–20.

Birstein, Y. A., and Ljovushkin, S. I. (1965*b*). Subterranean Paraselloidea (Crustacea, Isopoda) in USSR. *Russkii Zoologischeskii Zhurnal* **44**, 997–1013.

Bocquet, C. (1950). Le probleme taxonomique des *Jaera marina* (Fabr.) (*J. albifrons* Leach). *Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, Paris* **230**, 132–4.

Bocquet, C. (1953). Recherches sur le polymorphisme naturel de *Jaera marina*. *Archives de Zoologie Expérimentale et Générale* **90**, 187–450.

Bocquet, C. (1970). Sur un nouveau Microparasellide marin des sables de Roscoff, *Microcharon monnioti* n.sp. (Isopoda, Asellota). *Comptes Rendus de l'Academie des Sciences, Paris* **271**, 85–7.

Bocquet, C., and Lévi, C. (1955). *Microjaera anisopoda*, n.g. n.sp., Isopode psammique de la sous-famille nouvelle des Microjaniridae. *Archives de Zoologie Expérimentale et Générale* **92**, 116–34.

Bocquet, C., and Prunus, G. (1963). Recherches complementaires sur le polytypisme de la super-espèce *Jaera albifrons* Leach = *Jaera marina* (Fabricius). I. Redescription de l'espèce *Jaera (albifrons) posthirsuta* Forsman. *Bulletin Biologique de France et Belgique* **97**, 343–53.

Bonnier, J. (1896). Édriophthalmes. Resultats scientifiques de la campagne du 'Caudan' dan le golfe de Gascogne. *Annales Université de Lyon* **1895**, 527–689.

Boone, P. L. (1920). Isopoda of the Canadian Arctic and adjoining regions. In 'Report of the Canadian Arctic Expedition 1913–18. Crustacea, part D'. Vol. 7, pp. 1–40.

Bovallius, C. (1881). *Ianthe*, a new genus of Isopoda. *Bihang Till Kungliga Svenska Vetenskap-Akademiens Handlingar* **6**, 1–14.

Bovallius, C. (1886). Notes on the family Asellidae. *Bihang Till Kungliga Svenska Vetenskap-Akademiens Handlingar* **11**, 1–54.

Bowman, T. E. (1988). *Nitokra sphaeromata*, a new harpacticoid copepod crustacean associated with the wood-boring isopod, *Sphaeroma peruvianum*, in Costa Rica. *Proceedings of the Biological Society of Washington* **101**, 171–5.

Bowman, T. E., and Abele, L. G. (1982). Classification of the recent Crustacea. In 'Systematics, the Fossil Record, and Biogeography'. (Ed. L. G. Abele.) pp. 1–27. In Series 'The Biology of Crustacea'. Vol. 1. (Series Ed. D. E. Bliss.) (Academic Press: New York.)

Bowman, T. E., and Morris, B. F. (1979). *Carpias* Richardson 1902, a senior synonym of *Bagatus* Nobili 1906, and the validity of *Carpias minutus* (Richardson 1902) (Isopoda: Asellota: Janiridae). *Proceedings of the Biological Society of Washington* **92**, 650–7.

Bowman, T. E., Prins, R., and Arenas, J. (1987). The occurrence of the freshwater isopod *Heterias (Fritzianira) exul* in the Lakes region of Chile, with notes on the genus *Heterias* (Asellota: Janiridae). *Hydrobiologia* **146**, 275–81.

Branch, M. L., Griffiths, C. L., Kensley, B., and Sieg, J. (1991). The benthic Crustacea of subantarctic Marion and Prince Edward Islands: illustrated keys to the species and results of the 1982–1989 University of Cape Town surveys. *South African Journal of Antarctic Research* **21**, 3–44.

Brandt, A. (1991). A revision of the Acanthaspidiidae Menzies, 1962 (Isopoda: Asellota). *Zoological Journal of the Linnean Society* **102**, 203–52, 31 figs.

Brandt, A. (1993). Redescription of *Janiralata pulchra* (Hansen, 1916) from the Kolbeinsey Ridge, North Atlantic and synonymy with *Ianthopsis pulchra* (Acanthaspidiidae) (Crustacea, Isopoda). *Ophelia* **37**, 127–41.

Brian, A., and Dartevelle, E. (1949). Contribution a l'étude des isopodes marins et fluviatiles du Congo. *Annales du Musée du Congo Belge, série C, Zoologie* **1** (Suppl. 3), 77–208.

Brusca, R. C. (1987). Biogeographic relationships of Galapagos marine isopod crustaceans. *Bulletin of Marine Sciences* **41**, 268–81.

Bubel, A., and Jones, M. B. (1974). Fine structure of the gills of *Jaera nordmanni* (Rathke) (Crustacea, Isopoda). *Journal of the Marine Biological Association of the United Kingdom* **54**, 737–45.

Cariou, M. L. (1977). Recherches sur le polymorphisme enzymatique du complexe *Jaera albifrons* Leach (Crustacè, Isopode). Thèse, Université du Paris VI, 77 pp.

Cariou, M. L. (1985). Distance genetiques et analyses multidimensionnelles: differention genetique des espèces du complexe *Jaera albifrons* (Crustacs, Isopodes). *Mémoires de la Société Zoologique de France* **42**, 281–95.

Carvacho, A. (1981). Le genre *Janira* Leach avec description d'une nouvelle espèce (Isopoda, Asellota). *Crustaceana* **41**, 131–42.

Carvacho, A. (1982). Isópodos litorales de la Costa de Concepción Chile Central. *Studies on Neotropical Fauna and Environment* **17**, 195–207.

Carvacho, A. (1983). Asellota del Golfo de California, con descripción de dos nuevos géneros y dos nuevas especies (Crustacea, Isopoda). *Cahiers de Biologie Marine* **24**, 281–95.

Castro, A. L. de, and Lima, I. M. B. (1977). *Fritzianira*, a new genus for *Janira exul* Müller. *Crustaceana* **32**, 1–6.

Chappuis, P. A. (1942). *Microcharon acherontis* spec. nov., ein neuer subterraner Isopode. *Fragmenta Faunistika Hungarica* **5**, 120–1.

Chappuis, P. A. (1944). Die Grundwasserfauna und des Körösund des Szamos. *Math. Természzwttudományi Közlemények* **40**, 12–20.

Chappuis, P. A. (1951). Un nouveau Parasellide de Tasmanie, *Pseudasellus nicholsi* n. gen. n. sp. *Archives de Zoologie Expérimentale et Générale, Notes et Revues II* **88**, 7–19.

Chappuis, P. A. (1958). Crustacés des eaux douces de l'ile Amsterdam: *Protocharon antarctica* n. sp. *Mémoires Institute Scientifique de Madagascar, série A* **12**, 13–24. (In French.)

Chappuis, P. A., and Delamare-Deboutteville, C. (1952). Nouveaux isopodes du sable des plages du Roussillon. *Comptes Rendus de l'Acaemie des Sciences, Paris* **234**, 2014–16.

Chappuis, P. A., and Delamare-Deboutteville, C. (1954). Recherches sur les crustacés souterrains. VII. Les Isopodes psammiques de la Mediterranee. *Archives de Zoologie Expérimentale et Générale* **91**, 103–38.

Chappuis, P. A., and Delamare-Deboutteville, C. (1957). Un nouvel Asellide du l'Afrique du Sud. *Notes Biospéleologiques de France* **12**, 29–36.

Chappuis, P. A., and Delamare-Deboutteville, C. (1960). État de nos connaisance sur une famille et une sous famille: les Microparasellides et les Microcerberinae (Isopodes). In 'Biologie des Eaux Souterraines et Littorales'. (Ed. C. Delamare-Deboutteville.) *Vie et Milieu* (Supplement 9), 1–740.

Chappuis, P. A., Delamare-Deboutteville, C., and Paulian, R. (1956). Crustacées des eaux souterraines littorales d'une résurgence d'eau douce à la Réunion. *Mémoires Institute Scientifique de Madagascar, série A* **11**, 51–78.

Chilton, C. (1884). Additions to the sessile eyed Crustacea of New Zealand. *Transactions and Proceedings of New Zealand Institute* **16**, 249–65.

Chilton, C. (1909). The Crustacea of the Subantarctic Islands of New Zealand. *The Subantarctic Islands of New Zealand, Wellington* **2**, 601–71.

Chilton, C. (1912). Miscellaneous notes on some New Zealand Crustacea. *Transactions and Proceedings of New Zealand Institute* **44**, 128–35.

Cléret, J. C. (1973). Isopodes et Tanaidacés. Invertébrés de l'infralittoral rocheux dans l'archipel de Kerguelen. II. *Comité Nationale Française Recherches Antarctiques* **33**, 31–6.

Coineau, N. (1963*a*). Contribution à l'étude des isopodes aquatiques. I. *Microcharon marinus* Chappuis et Delamare, et *Microcharon angelieri* n. sp. (Microparasellidae). *Vie et Milieu* **13**, 711–27.

Coineau, N. (1963*b*). Présence de *Microcharon angelieri* dans la nappe phréatique de la Baillaurie (Banyuls-sur Mer). *Vie et Milieu* **14**, 197–9.

Coineau, N. (1968). Contribution à l'études de la faune interstitielle. Isopodes et Amphipodes. *Mémoires du Muséum National d'Histoire Naturelle, série A Zoologie* **55**, 145–216.

Coineau, N. (1969). Biologie des Isopodes interstitiels. Ph.D. Thesis, Faculté des Sciences, Université de Paris, 230 pp.

Coineau, N. (1970). Isopodes interstitiels de Nouvelle-Calédonie. *Expedition française récifs coralliens Nouvelle-Calédonie 1960–1963* **4**, 353–76.

Coineau, N. (1971). Les isopodes interstitiels. Dociments sur leur écologie et leur biologie. *Mémoires du Muséum National d'Histoire Naturelle, série A Zoologie* **64**, 1–170.

Coineau, N. (1977). La faune terrestre de l'ile de Sainte-Hélène. 4. *Annales du Musée Royale Afrique Centrale, Tervuren série in octavo, Sciences Zoologiques* **220**, 427–43.

Coineau, N. (1981). Aspects de la dynamique des populations chez un isopode interstitiel. *Bijdragen tot de Dierkunde* **51**, 20–30.

Coineau, N. (1986). Isopoda: Asellota: Janiroidea. In 'Stygofauna Mundi'. (Ed. L. Botosaneanu.), pp. 465–72. (E. J. Brill & Dr. W. Backhuys: Leiden.)

Coineau, N. (1992). Évolutive du Crustacé interstitiel *Microcharon* (Isopoda, Janiroidea) dans l'Ouest du Bassin Mediterraneen. *Bulletin de l'Institut Océanographique (Monaco)* **9** (Special Number), 101–14.

Coineau, N., and Botosaneanu, L. (1973). Isopodes interstitiels de Cuba. *Résultats Expédition Biospéleologique Cubano Roumaines à Cuba* **1**, 191–221.

Coineau, N., and Rao, C. G. (1972). Isopodes et Amphipodes des sables intertidaux des îles Andaman et Nicobar (Golfe du Bengal). *Vie et Milieu, série A* **23**, 65–100.

Coineau, N., and Renaud-Mornant, J. (1977). Étude anatomique des isopodes interstitiels. II. Morphologie fonctionelle et évolution saisonniére de l'appareil génital femelle d'*Angliera phreaticola*. *Archives de Zoologie Expérimentale et Générale* **118**, 349–66.

Coineau, N., and Schmidt, P. (1979). Interstitielle Fauna von Galapagos, XXIV. Microparasellidae (Isopoda, Asellota). *Mikrofauna des Meersbodens* **73**, 143–59.

Cooke, W. J. (1977). On the occurrence of the commensal asellote *Caecijaera horvathi* Menzies, 1951 in Hawaii. *Crustaceana* **33**, 105–6.

Costa, A. (1853). Genere *Jaera* Leach. In 'Fauna del Regno di Napoli. Crostacei Isopodi'. (Ed. O. G. Costa.) Vol. 83, pp. 1–4.

Cvetkov, L. (1964). Materiaux sur les Isopodes souterraines de Bulgarie. *Microcharon apolloniacus* n. sp., *M. thracicus* n. sp. *Izvestiya Zoologicheskiya Institut Sofia* **16**, 201–13.

Cvetkov, L. (1965). Isopodes souterrains de la Thrace. *Fauna Thrakiya* **2**, 311–17.

Cvetkov, L. (1967). Materiaux sur les Isopodes souterrains de Bulgarie. II. *Microcharon major* Karaman et *Microcharon phlegetonis* n. sp. *Comptes Rendus Académie Bulgare des Sciences* **20**, 951–4.

Cvetkov, L. (1968). Morphologie des premiers pléopods, evolution et position systematique du genre *Microcharon* (Crustacea, Isopoda). *Izvestiya Zoologicheskiya Institut Sofia* **27**, 107–40. (In French.)

Cvetkov, L. (1976). Matériaux sur les isopodes souterraines de Bulgarie. 3. *Microcharon bureschi* n. sp. *Acta Zoologica Bulgaria* **4**, 81–4. (In French.)

Cvetkov, L. (1977). Matériaux sur les isopodes souterraines de Bulgarie. 4. *Microcharon eurydices* Cvetkov et *Microcharon orphei* n. sp. *Acta Zoologica Bulgaria* **7**, 70–3. (In French.)

Dahl, F. (1916). 'Die Asselen oder Isopoden Deutschlands.' (G. Fischer Verlag: Jena.)

Dana, J. D. (1852). Crustacea. In 'United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N.'. Vol. 14, Chapt. 2, pp. 696–805. (C. Sherman: Philadelphia.) (Atlas, 1885, pls 46–52.)

Delage, Y. (1881). Contribution a l'étude de l'appareil circulatoire des crustacés edriophthalmes marins. *Archives de Zoologie Expérimentale et Générale* **9**, 1–173.

Delamare-Debouttevillle, C. (1960). Biologie des eaux souterraines littorales et continentales. *Vie et Milieu* **9**, 1–740.

Delamare-Debouttevillle, C., and Chappuis, P. A. (1956). Recherches sur la faune intersitielle des sédiments marins et d'eau douce à Madagascar. VIII. *Angeliera phreaticola* Chapp. et Delam., le premiere Microparasellidae souterrain de Madagascar (Crustacé Isopode). *Mémoires de l'Institut scientifique de Madagascar, série A* **10**, 89–94.

Dole, M. J., and Coineau, N. (1987). L'isopode *Microcharon* (Crustacea, Isopoda) abondant dans les eaux interstitielles de l'est Lyonnais. *M. reginae* n. sp., ecologie et biogeographie. *Stygologia* **3**, 200–16.

Dollfus, A. (1889). Description d'un Isopode fluviatile du genre *Jaera* provenant de l'ile de Florés (Açores). *Bulletin de la Société Zoologique de France* **14**, 133–4.

Dollfus, A. (1891). Crustacés isopodes. In 'Mission Scientifique de Cap Horn 1882–1883. Zoologie'. (Ed. A. Dollfus.) Chapt. 6, pp. 55–76.

Dons, C. (1935). Zoologische Notizen. 28. Isopoden aus der Möre-Küste und Nord-Norwegen. *Konglige norske Videnskabers Selskab Forhandlingar* **8**, 41–3.

Fabricius, O. (1780). 'Fauna Groenlandica. Hafniae et Lipsiae.'

Fee, A. R. (1927). The Isopoda of Departure Bay and vicinity with descriptions of new species, variations and colour notes. *Contributions to Canadian Biology and Fisheries, new series* **3**, 15–34.

Forsman, B. (1944). Beobachtungen über *Jaera albifrons* Leach an der schwedischen Westküste. *Arkiv für Zoölogi* **35A**, 1–33.

Forsman, B. (1949). Weitere Studien über die Rassen von *Jaera albifrons* Leach. *Zoologiska Bidrag fran Uppsala* **27**, 449–63.

Franke, H. D. (1993). Mating system of the commensal marine isopod *Jaera hopeana* (Crustacea). 1. The male-manca (I) amplexus. *Marine Biology* **115**, 65–73.

Fresi, E. (1968). Presenza di *Bagatus stebbingi* Monod (Isopoda: Asellota) nel Golfo di Napoli. *Publicazione della Stazione Zoologica di Napoli* **36**, 271–72.

Fresi, E., Idato, E., and Scipione, M. B. (1980). The Gnathostenetroidea and the evolution of primitive asellote isopods. *Monitore Zoologico Italiano, new series* **14**, 119–36.

Galassi, D. M. P. (1991). A new *Microcharon* Karaman, from hyporheic waters of Greece: *Microcharon antonellae* n. sp. (Crustacea Isopoda: Microparasellidae). *Stygologia* **6**, 201–7.

Galasi, D. M. P., Tiberio, A., and Pesce, G. L. (1990). SEM investigations on mouthparts of some freshwater species of the genus *Microcharon* Karaman (Isopoda: Microparasellidae). *Atti Congress Unione Zoologia Italiana* **1990**, 265.

Galhano, M. H. (1966). Prineiras pesquisas sobre crustàceos intersticialis dos sedimentos marinhos de Portugal. *Publicaçoes Instituto Zoologico Dr Auguste Nobre* **96**, 9–16.

Galhano, M. H. (1970). Contrubuiçao para o conhecimento de fauna intersticial em Portugal. *Publicaçoes Instituto Zoologico Dr Auguste Nobre* **110**, 1–206.

Geldiay, R., and Kocatas, A. (1972). Isopods collected in Ismir Bay, Aegean Sea. *Crustaceana* **3** (Supplement), 19–30.

George, R. Y., and Menzies, R. J. (1968). Additions to the Mediterranean deep-sea isopod fauna (Vema-14). *Revue Roumanie de Biologie (Zoologie)* **13**, 367–83.

George, R. Y., and Strömberg, J. O. (1968). Some new species and new records of marine isopods from San Juan Archipelago, Washington, U.S.A. *Crustaceana* **14**, 225–54.

Giambiagi, D. (1925). Resultados de la primera expedicíon a Tierra del Fuego (1921). Crustáceos Isópodos. *Anales de la Sociedad Cientifica Argentine* **1925**, 1–20.

Gnanamuthu, C. P. (1954). Two new sand-dwelling isopods from the Madras sea shore. *Annals and Magazine of Natural History (series 12)* **7**, 257–73.

Gourret, P. (1891). Les Lémodipodes et les Isopodes du golfe de Marseille. *Annales du Musée d'Histoire Naturelle de Marseille, Zoologie* **4**, 1–44, 6 pl.

Gruner, H. E. (1965). Crustacea. V. Isopoda (1). In Series 'Die Tierwelt Deutschlands und der angrenzenden Meeresteile', 51. (G. Fischer Verlag: Jena.)

Gurjanova, E. F. (1932). The Isopods of Arctic Seas. In 'Analytical Tables of the Fauna of the USSR'. Vol. 4, pp. 1–35. In Series 'Issled Zoologii Institutom Academii Nauk'. (Academii Nauk: Leningrad.) (In Russian.)

Gurjanova, E. F. (1933). Die marinen Isopoden der Arktis. In 'Fauna Arctica'. (Eds F. Römer and F. Schaudinn.) Vol. 6, pp. 392–472. (G. Fischer Verlag: Jena.) (In German.)

Gurjanova, E. F. (1935). Contributions to the Isopod Fauna of the Pacific Ocean. III. New species in the collection of the Pacific expedition of the State Hydrological Institute, 1932. In 'Exploration of the Sea of the USSR'. Vol. 22, pp. 25–35. (Academy of Sciences of the U.S.S.R.: Leningrad.) (In Russian.)

Gurjanova, E. F. (1936*a*). Beiträge zur Kenntnis der Isopoden fauna des Pazifischen Ozeans. IV. Neue Isopoden-arten aus dem Japanischen und Bering-Meer. *Zoologischer Anzeiger, Leipzig* **114**, 250–65.

Gurjanova, E. F. (1936*b*). Isopods of the Eastern Seas. In 'Crustacea'. Vol. 7, Chapt. 3, p. 280. In Series 'Fauna of the USSR'. Vol. 6. (Academy of Sciences of the U.S.S.R.: Leningrad.) (In Russian.)

Gurjanova, E. F. (1938). Isopoda of the Bays of Sjauchu and Sudsuche (Sea of Japan) from Material of ZIN expedition of the Academy of Science of the USSR to the Sea of Japan in the year 1934. In 'Transactions of the Hydrobiological Expedition ZIN of Academy of Science of USSR in 1934 to the Sea of Japan'. Vol. 1, pp. 231–9. (Academy of the Sciences of U.S.S.R.: Leningrad.) (In Russian.)

Gurjanova, E. F. (1950). On the fauna of Isopoda from the Pacific Ocean. 5. Isopoda collected by the Kamchatka Marine Station of the State Hydrological Institute. In 'Exploration of the Far-Eastern Seas of the USSR'. Vol. 2, pp. 281–92. (Academy of Sciences of the U.S.S.R.: Leningrad.) (In Russian.)

Haahtela, I. (1965). Morphology, habitats and distribution of species of the *Jaera albifrons* group (Isopoda, Janiridae) in Finland. *Annales Zoologici Fennici* **2**, 309–14.

Haahtela, I., and Naylor, E. (1965). *Jaera hopeana*, an intertidal isopod new to the British fauna. *Journal of the Marine Biological Association of the United Kingdom* **45**, 367–71.

Hale, H. M. (1937). Isopoda and Tanaidacea. *Scientific Reports for the Australian Antarctic Expeditions, series C, Zoology and Botany* **2**, 1–45.

Hansen, H. J. (1888). Oversigt over det vestlige Grönlands Fauna of Malacostrake Havkrebsdyr. *Videnskbelije Meddelelser fra Dansk Naturhistorisk Forening København* **1887**, 177–98.

Hansen, H. J. (1905). On the morphology and classification of the Asellota group of crustaceans with descriptions of the genus *Stenetrium* Hasw, and its species. *Proceedings of the Zoological Society of London* **1904** (Suppl. II), 302–31.

Hansen, H. J. (1916). The order Isopoda. In 'Crustacea Malacostraca'. Vol. 3, Chapt. 5, pp. 1–262. In Series 'Danish Ingolf Expedition'. (Danish Museum: Copenhagen.)

Harger, O. (1879). Notes on New England Isopoda. *Proceedings of the United States National Museum* **2**, 157–65.

Harger, O. (1880). Report on the marine Isopoda of New England and adjacent waters. *Report of the U.S. Commission for Fisheries* **6**, 297–462.

Harrison, K. (1987). Deep-sea asellote isopods of the north-east Atlantic: the family Thambematidae. *Zoologica Scripta* **16**, 51–72.

Haswell, W. A. (1881). On some new Australian marine Isopoda. *Proceedings of the Linnean Society of New South Wales* **5**, 470–81.

Haswell, W. A. (1882). 'Catalogue of the Australian stalk- and sessile-eyed Crustacea.' Vol. 1. (Australian Museum: Sydney.)

Hatch, M. H. (1947). The Chelifera and Isopoda of Washington and adjacent regions. *University of Washington Publications in Biology* **10**, 155–274.

Hauksson, E. (1980). *Janiropsis breviremis* (Isopoda: Janiridae) recorded from Iceland. *Natturufraedingurinn* **50**, 32–4.

Henry, J. P., and Magniez, G. (1991). Quelques asellotes (Isopoda) stygobies et obscuricoles du sud-est de la Corée. *Stygologia* **6**, 217–25.

Hessler, R. R. (1968). The systematic position of *Dactylostylis* Richardson (Isopoda, Asellota). *Crustaceana* **14**, 143–6.

Hessler, R. R. (1970). The Desmosomatidae (Isopoda, Asellota) of the Gay Head–Bermuda Transect. *Bulletin of the Scripps Institution of Oceanography* **15**, 1–185.

Hessler, R. R., and Sanders, M. L. (1967). Faunal diversity in the deep sea. *Deep-Sea Research* **14**, 65–78.

Hessler, R. R., and Thistle, D. (1975). On the place of origin of deep-sea isopods. *Marine Biology* **32**, 155–65.

Hessler, R. R., Wilson, G., and Thistle, D. (1979). The deep-sea isopods: a biogeographic and phylogenetic overview. *Sarsia* **64**, 67–76.

Hodgson, T. V. (1902). Crustacea. In 'Report on the Collections of Natural History, made in the Antarctic Regions during the Voyage of the "Southern Cross"'. pp. 228–69. (W. Cloves and Sons: London.)

Hodgson, T. V. (1910). Crustacea IX. Isopoda. In 'National Antarctic Expedition 1901–1904. Natural History'. (Ed. S. F. Harmer.) Vol. 5 (Zoology and Botany), pp. 1–77, 10 pls. (British Museum (Natural History): London.)

Holdgate, M. W. (1961). The fresh water fauna of Gough Island (South Atlantic). *Proceedings of the Linnean Society of London* **172**, 8–24.

Holthuis, L. B. (1949). The Isopoda and Tanaidacea of the Netherlands, including the description of a new species of *Limnoria*. *Zoologische Mededelingen (Leiden)* **30**, 163–90.

Holthuis, L. B. (1950). Isopodes et Tanaidacés marins de la Belgique; remarques sur quelques espéces de la zone meridionale de la Mer du Nord. *Bulletin Institute Royale des sciences Naturelles Belgique* **26**, 1–19.

Holthuis, L. B. (1952). Einige interessante met drijvende Kust angespoelde Zeepissebetden en Zeepokken. *Levende Natuur* **55**, 72–7.

Holthuis, L. B. (1956). Isopoda en Tanaidacea. *Fauna van Nederland, Leiden* **161**, 1–280.

Hooker, A. (1985). New species of Isopoda from the Florida Middlegrounds (Crustacea: Peracarida). *Proceedings of the Biological Society of Washington* **98**, 255–80.

Horwitz, P., and Knott, B. (1991). The faunal assemblage in freshwater crayfish burrows in sedgeland and forest at Lightning Plains, western Tasmania. *Papers and Proceedings of the Royal Society of Tasmania* **125**, 29–32.

Hult, J. (1941). On the soft-bottom isopods of the Skager-Rak. *Zoologiska Bidrag fran Uppsala* **21**, 1–234, 42 figs, 21 maps.

Hurley, D. E. (1956). The New Zealand species of *Iais*. *Transactions of the Royal Society of New Zealand (Zoology)* **83**, 715–19.

Hurley, D. E. (1957). Some Amphipoda, Isopoda and Tanaidacea from Cook Strait. *Zoology Publications from Victoria University of Wellington* **21**, 1–20.

Hurley, D. E. (1961). A checklist and key to the Crustacea Isopoda of New Zealand and Subantarctic Islands. *Transactions of the Royal Society of New Zealand (Zoology)* **1**, 259–92.

Hutton, F. W. (Ed.) (1904). 'Index Faunae Novae-Zealandiae.' (British Museum (Natural History): London.)

Ingolfsson, A. (1980). Distribution and habitat preferences of *Jaera* spp. (Isopoda: Asellota) in Iceland. *Natturufraedingurinn* **49**, 97–104.

Iverson, E. W. (1974). Range extensions for some California marine isopod crustaceans. *Bulletin of the Southern California Academy of Sciences* **73**, 164–9.

Jang, I. K. (1991). A new species of the genus *Janiralata* (Crustacea, Isopoda, Janiridae) from Korea. *Korean Journal of Zoology* **34**, 64–8.

Jang, I. K., and Kwon, D. H. (1990). *Ianiropsis* (Isopoda, Asellota, Ianiridae) from Korea, with description of a new species. *The Korean Journal of Systematic Zoology* **6**, 193–208.

Jankovskaja, A. J. (1964). Relict crustaceans of coastal bottom waters of the Lake Issyk Kul (North Tien-Shan). *Russkii Zoologischeskii Zhurnal* **43**, 975–86. (In Russian.)

Jazdzewski, K. (1969). Ecology and biology of species of the *Jaera albifrons* group (Isopoda, Asellota) in the Bay of Puck, Polish Baltic Sea. *Crustaceana* **17**, 265–81.

Jaume, D., and Garcia, L. (1990). Revision de la especie politipica *Jaera nordmanni* (Rathke, 1837) (Isopoda, Asellota, Janiridae) de las aguas dulces de Mallorca. *Miscellanea Zoologica (Barcelona)* **12** (1988), 79–88.

Jones, M. B. (1974). Breeding biology and seasonal population changes of *Jaera nordmanni nordica* Lemercier (Isopoda, Asellota). *Journal of the Marine Biological Association of the United Kingdom* **54**, 727–36.

Just, J. (1990). Abyssianiridae, a synonym of Paramunnidae (Crustacea: Isopoda: Asellota), with two new species of *Abyssianira* from south-eastern Australia. *Memoirs of the Museum of Victoria* **50**, 403–15.

Just, J., and Poore, G. C. B. (1992). Vermectiadidae, a new primitive asellote isopod family with important phylogenetic implications. *Journal of Crustacean Biology* **12**, 125–44.

Karaman, S. (1933). Neue Isopoden aus unterirdischen Gewässern Jugoslaviens. *Zoologischer Anzeiger* **102**, 26–32.

Karaman, S. (1934). Beiträge zur Kenntnis der Isopodenfamilie Microparasellidae. *Mitteilungen der Höhlen und Karstforschung* **1934**, 42–4.

Karaman, S. (1940). Die unterirdischen Isopoden Südseebiens. *Bulletin de la Société scientifique de Skopje* **22**, 19–53.

Karaman, S. (1953). Uber die *Jaera*-arten Jugoslaviens. *Acta Adriatica* **5**, 1–20.

Karaman, S. (1954). Weitere Beiträge zur Kenntnis der Microparaselliden Mazedoniens, das Genus *Microcharon* Karaman. *Fragmenta Balcanica, Skopje* **1**, 107–14.

Karaman, S. (1958). Weitere Beträge zur Kenntnis der Amphipoden und Isopoden Jugoslaviens und Griechenlands. *Bioloski Glasnik Hrvatsko prirodoslovno drustvo* **11**, 11–22.

Karaman, S. (1959). Uber eine neue *Microcharon*-Art (Crustacea, Isopoda) aus den Karstgebiete der Herzegowina. *Acta Zoologica, Budapest* **4**, 333–8. (In German.)

Kensley, B. (1976). Isopodan and Tanaidacean Crustacea from the St Paul and Amsterdam Islands, Southern Indian Ocean. *Annals of the South African Museum, Capetown* **69**, 261–323.

Kensley, B. (1978). 'Guide to the Marine Isopods of Southern Africa.' (South African Museum & The Rustica Press: Wynberg, Cape Town.)

Kensley, B. (1984*a*). The Atlantic barrier reef ecosystem at Carrie Bow Cay, Belize. III. New marine Isopoda. *Smithsonian Contributions to the Marine Sciences* **24**, 1–81.

Kensley, B. (1984*b*). The role of isopod crustaceans in the reef crest community at Carrie Bow Cay, Belize. *Marine Ecology* **5**, 29–44.

Kensley, B. (1984*c*). The South African Museum's *Meiring Naude* cruises. Part 15. Marine Isopoda of the 1977, 1978, 1979 Cruises. *Annals of the South African Museum, Capetown* **93**, 213–301.

Kensley, B. (1988). Preliminary observation on the isopod crustacean fauna of Aldabra Atoll. *Bulletin of the Biological Society of Washington* **8**, 40–4.

Kensley, B. (1989). Marine isopod crustaceans from the St. Paul and Amsterdam Islands, southern Indian Ocean. *Bulletin du Muséum National d'Histoire Naturelle, 4^{e} série (A) Zoologie, Biologie et Ecologie Animales* **11**, 147–64.

Kensley, B., and Schotte, M. (1989). 'Guide to the Marine Isopod Crustaceans of the Caribbean.' (Smithsonian Institution Press: Washington, D.C. & London.)

Kensley, B., and Snelgrove, P. (1987). Records of marine isopod crustaceans associated with the coral *Madracis mirabilis* from Barbados. *Proceedings of the Biological Society of Washington* **100**, 186–97.

Kesselyák, A. (1938). Die Arten der Gattung *Jaera* Leach (Isopoda, Asellota). *Zoologische Jahrbücher, Abteilung für Systematik Ökologie und Geographie der Tiere* **71**, 219–52. (In German.)

Klochenko, L. A. (1986). The discovery of *Jaera sarsi* (Crustacea, Isopoda) in the lower reaches of the Southern Bug. *Vestnik Zoologii* **1986**, 85. (In Russian.)

Koehler, R. (1885). Description d'un Isopode nouveau, le *Joeropsis brevicornis*. *Annales des Sciences Naturelles, Paris, Zoologie et Biologie Animal, 6^{e} série* **19**, 1–7.

Krøyer, H. (1849). Karcinologiste Bidrag. *Naturhistorisk Tidsskrift Kjøbenhaven, series 2* **1846–1849**, 1–123, 366–446.

Kussakin, O. G. (1956). Fauna and flora of the eulittoral zone of the Island Kunashir. *Trudy Problemnoi i Tematicheskikh Soveshchanii Zoologischeskii Instituta Akademii Nauk SSSR* **6**, 98–115. (In Russian.)

Kussakin, O. G. (1962). On the fauna of Janiridae (Isopoda, Asellota) from the Seas of the USSR. *Trudy Zoologicheskogo Instituta Akademii Nauk SSSR* **30**, 17–65. (In Russian.)

Kussakin, O. G. (1967). Fauna of Isopoda and Tanaidacea in the coastal zones of the Antarctic and subantarctic water. In 'Biological Reports of the Soviet Antarctic Expedition (1955–1958)'. (Eds A. P. Andriyashev and P. V. Ushakov.) Vol. 3, pp. 220–380. In Series 'Issled Fauna Moreii', 4(12). (Series Ed. E. P. Pavlovskii.) (Akademii Nauk SSSR: Leningrad.) (In Russian, translated 1968 by Israel Program for Scientific Translations, Jerusalem.)

Kussakin, O. G. (1969). Isopoda. In 'Free Living Invertebrates, Crustacea'. (Ed. O. G. Kussakin.), pp. 408–40. In Series 'Key to the Fauna of the Black Sea and Sea of Azov', 2. (Naukova Dunka: Kiev.) (In Russian.)

Kussakin, O. G. (1972). Isopoda from the coastal zone of the Kurile Islands. I. Janiridae and Jaeropsidae from Urup Island. In 'Studies on Peracarida'. *Crustaceana* (Supplement 3), 155–65.

Kussakin, O. G. (1973). Peculiarities of the geographical and vertical distribution of marine isopods and the problem of deep-sea fauna origin. *Marine Biology* **23**, 19–34.

Kussakin, O. G. (1974). Fauna and ecology of isopods (Crustacea) from the intertidal zone of the Kurile Islands. In 'Flora and Fauna of the Intertidal Zone of the Kurile Islands'. Vol. 1, pp. 227–75. In Series 'Far East Science Center, Institute of Marine Biology, Transactions'. (Akademii Nauk, SSSR: Novosibirsk.) (In Russian.)

Kussakin, O. G. (1975). A list of the macrofauna in the intertidal zone of the Kurile Islands, with remarks on zoogeographical structure of the region. *Publications of the Seto Marine Biological Laboratory* **23**, 47–74. (In Russian.)

Kussakin, O. G. (1979*a*). The isopod fauna (Crustacea, Isopoda) of the Okhotsk Sea. In 'Investigations of Pelagic and Bottom Organisms from the Far Eastern Seas'. Vol. 15, pp. 106–22. In Series 'Issledovaniya Pelagicheskikh i Donnykh Oprannizmov Dal'nevostochiykh Morei'. (Akademii Nauk, SSSR: Vladivostok.) (In Russian.)

Kussakin, O. G. (1979*b*). Marine and brackishwater likefooted Crustacea (Isopoda) from the cold and temperate waters of the Northern Hemisphere. Suborder Flabellifera. Vol. 1. In Series 'Opredeliteli po Faune SSSR, Izdavaemye Zoologicheskim Institutom Akademii Nauk SSSR', 122. (Izdatel'stvo Nauka: Leningrad.) (In Russian.)

Kussakin, O. G. (1982). Supplement to the isopod crustacean fauna from the shelf zones of the Antarctic (From the material of the Soviet Antarctic Expedition 1965–1968). In 'Fauna and Distribution of Crustaceans from the Southern and Antarctic Waters'. (Ed. A. I. Kafanov.) pp. 73–105. (Academy of Sciences of the USSR, Far East Science Center: Vladivostok.) (In Russian.)

Kussakin, O. G. (1988). 'Marine and Brackishwater Likefooted Crustacea (Isopoda) from the Cold and Temperate Waters of the Northern Hemisphere. Suborder Asellota. Part 1. Families Janiridae, Santidae, Dendrotionidae, Munnidae, Paramunnidae, Haplomunnidae, Mesosignidae, Haploniscidae, Mictosomatidae, Ischnomesidae.' Vol. 3. In Series 'Opredeliteli po Faune SSSR, Izdavaemye Zoologicheskim Institutom Academii Nauk SSSR', 152. (Izdatel'stvo Nauka: Leningrad.) (In Russian.)

Kussakin, O. G., and Mezhov, B. V. (1979). Isopod Crustacea of the sublittoral and the upper bathyal zone of the Kurile Islands. In 'Biology of the Shelf of the Kurile Islands'. (Ed. O. G. Kussakin.) pp. 125–99. (Academy of Sciences, USSR, Far East Science Center, Institute of Marine Biology: Moscow.) (In Russian.)

Kussakin, O. G., and Vasina, G. S. (1980). Additions to the marine Isopoda and Gnathiida of Kerguelen Islands (Southern Indian Ocean). *Tethys* **9**, 355–69. (In Russian.)

Kussakin, O. G., and Vasina, G. S. (1984). Deep-sea lower asellotes from the Scotia Sea and South Sandwich Trench. *Biologiya Morya (Vladivostok)* **6**, 9–17. (In Russian.)

Latreille, P. A. (1829). Crustacés, Arachnides et partie des Insectes. In 'La Règne Animale Distribuès d'Après son Organisation, pour Servir de Base à l'Histoire Naturelle des Animaux et d'Introduction à la Anatomie Comparée'. 2nd Edn. (Ed. G. Cuvier.) Vol. IV, pp. 129–44.

Leach, W. E. (1814). Crustaceology. In 'The Edinburgh Encyclopaedia'. 1st Edn. (Ed. D. Brewster.) Vol. 7, pp. 383–437, pl. 221. (Baldwin: London.)

Leach, W. E. (1815). A tabular view of the external characters of four classes of animals which Linné arranged under *Insecta* with the distribution of the genera composing three of these classes into orders, and description of several new genera and species. *Transactions of the Linnean Society of London* **11**, 306–400.

Lécher, P. (1962). Étude de la formule chromosomique de l'isopode asellote *Jaera marina posthirsuta* Forsman. *Comptes Rendus de l'Academie des Sciences, Paris* **254**, 561–3.

Lemercier, A. (1957). Sur le développement in vitro des embryons d'un crustacé Isopode Asellote: *Jaera marina* (Fabr.). *Comptes Rendus de l'Academie des Sciences, Paris* **244**, 1280–3.

Lemercier, A. (1958*a*). Charactéres morphologiques des pièces buccales de *Jaera marina* (Fabr.). *Mémoires de la Société des Science naturelles, Cherbourg* **47**, 86–95.

Lemercier, A. (1958*b*). Sur l'existence d'un complexe *Jaera nordmanni* (Rathke) (Isopode Asellote). *Comptes Rendus de l'Academie des Sciences, Paris* **246**, 3687–90.

Lemercier, A. (1960). La super-espéce *Jaera nordmanni* (Kathke) (Isopodes Asellotes, Janiridae). *Crustaceana* **1**, 9–27.

Lévi, C. (1950). *Duslenia teissieri*, n. g., n. sp., nouveau Parasellidé des côtes de France. *Archives de Zoologie Expérimentale et Générale* **87**, 42–7.

Lincoln, R. J., and Boxshall, G. A. (1983). A new species of *Deoterthron* (Crustacea: Tantulocarida) ectoparasitic on a deep-sea asellote from New Zealand. *Journal of Natural History* **17**, 881–90.

Margalef, R. (1952). Une *Jaera* dans les eaux douces des Baléares, *Jaera balearica* n. sp. (Isopoda, Asellota). *Hydrobiologia* **4**, 209–13.

Margalef, R. (1953). Los crustàceos de las aguas continentales ibericas. *Instituto Forestal de Investigaciones y Experiencias, Ministerio de Agricultura Madrid* **10**, 1–234.

Marsden, I. D. (1982). Population biology of the commensal asellotan *Iais pubescens* (Dana) and its sphaeromatid host *Exosphaeroma obtusum* (Dana)(Isopoda). *Journal of Experimental Marine Biology and Ecology* **58**, 233–57.

Matsumoto, K. (1956). On the two new subterranean water isopods, *Mackinia japonica* gen. n., sp. n. and *Asellus hubrichti* sp. n. *Bulletin of the Japanese Society for Science and Fisheries* **21**, 1219–25.

Matsumoto, K. (1967). Results of the speleological survey in South Korea, 1966. VII. Isopod crustaceans from subterranean waters of South Korea. *Bulletin of the National Science Museum, Tokyo* **10**, 259–83.

Meinert, F. (1877). Crustacea Isopoda, Amphipoda and Decapoda Daniae. Fortegnelse over Denmarks isopode, amphipode og decapode Krebsdyr. *Naturhistorisk Tidsskrift Kjøbenhaven, ser. 3* **11**, 57–248.

Menzies, R. J. (1951*a*). A new genus and new species of asellote isopod, *Caecijaera horvathi*, from Los Angeles–Long Beach Harbor. *American Museum Novitates* **1542**, 1–7.

Menzies, R. J. (1951*b*). New marine isopods, chiefly from Northern California, with notes on related forms. *Proceedings of the United States National Museum* **101**, 105–56.

Menzies, R. J. (1952). Some marine asellote isopods from northern California, with descriptions of nine new species. *Proceedings of the United States National Museum* **102**, 117–59.

Menzies, R. J. (1956). New bathyal Isopoda from the Caribbean with observations on their nutrition. *Breviora (Museum of Comparative Zoology)* **63**, 1–10.

Menzies, R. J. (1962*a*). The isopods of abyssal depths in the Atlantic Ocean. In 'Abyssal Crustacea'. (Ed. M. Ewing.) pp. 79–206. In Series 'Vema Research Series', Vol. 1. (Columbia University Press: New York.)

Menzies, R. J. (1962*b*). 'The Zoogeography, Ecology, and Systematics of the Chilean Marine Isopods.' In Series 'Reports of the Lund University Chile Expedition 1948–49', No. 42. (Lunds Universitets Årrskrifter Vol. 57, No. 11, Kungliga Fysiografiska Sallskapets Handlingar Bd 72 Nr 11.) (C. E. K. Gleerup: Lund.) (Resumé in Spanish.)

Menzies, R. J., and Barnard, J. C. (1951). The isopodan genus *Iais* (Crustacea). *Bulletin of the Southern Californian Academy of Science* **50**, 136–51.

Menzies, R. J., and Barnard, J. L. (1959). Marine Isopoda of coastal shelf bottoms of Southern California—systematics and ecology. *Pacific Science Naturalist* **1**, 3–35.

Menzies, R. J., and Frankenberg, D. (1968). Systematics and distribution of the bathyal–abyssal genus *Mesosignum* (Crustacea: Isopoda). In 'Biology of the Antarctic Seas. III'. (Eds G. Llano and W. Schmitt.) *Antarctic Research Series* **11**, 113–40.

Menzies, R. J., and George, R. Y. (1972). Isopod Crustacea of the Peru–Chile Trench. *Anton Bruun Report* **9**, 1–124. (Texas A&M Press: College Station, Texas.)

Menzies, R. J., and Glynn, P. W. (1968). The common marine isopod Crustacea of Puerto Rico. *Studies on the Fauna of Curaçao and other Caribbean Islands* **27**, 1–133.

Menzies, R. J., and Kruczynski, W. L. (1983). Isopod Crustacea (exclusive of Epicaridea). *Memoirs of the Hourglass Cruises* **6**, 1–126.

Menzies, R. J., and Pettit, J. (1956). A new genus and species of marine asellote isopod, *Caecianiropsis psammophila* from California. *Proceedings of the United States National Museum* **106**, 441–6.

Menzies, R. J., and Schultz, G. A. (1968). Antarctic isopod Crustacea. II. Families Haploniscidae, Acanthaspidiidae, and Jaeropsidae, with diagnoses of new genera and species. In 'Biology of the Antarctic Seas. III'. (Eds W. Schmidt and E. Llano.) *Antarctic Research Series* **11**, 141–84.

Mezhov, B. V. (1981). Isopod fauna of the sublittoral of the Komandorski Islands. In 'Systematics and Chorology of the Hypogean Isopods of the Far Eastern Seas'. (Ed. N. A. Bandakurova.) Vol. 24, pp. 4–29. (Academia Nauk, Far Eastern Center for Marine Biology: Vladivostok.) (In Russian.)

Miller, M. A. (1941). The isopod Crustacea of the Hawaiian Islands, II. Asellota. *Occasional Papers of the Bishop Museum* **16**, 305–20.

Miller, M. A. (1967). Another asellote, *Hawaianira peleae* new genus and species, from the Hawaiian Islands (Crustacea; Isopoda). *Proceedings of the Biological Society of Washington* **80**, 187–94.

Miller, M. A. (1968). Isopoda and Tanaidacea from buoys in coastal waters of the continental United States, Hawaii, and the Bahamas. *Proceedings of the U.S. National Museum* **125**, 1–53.

Miller, M. A. (1975). Phylum Arthropoda: Crustacea, Tanaidacea and Isopoda. In 'Light's Manual: Intertidal Invertebrates of the Central Californian Coast'. (Eds R. I. Smith and J. T. Carlton.) pp. 277–312. (University of California Press: Berkeley.)

Milne-Edwards, H. (1840). 'Histoire naturelle des Crustacés.' Vol. 3. (Atlas 32 pp., 42 pls.)

Monod, T. (1925). Tanaidacés et Isopodes aquatiques de l'Afrique Occidentale et septemtrionale, 2^{e} partie: Tanaidacea (fin), Anthuridae, Stenetriidae, Jaeridae (Janirini), Munnidae (Munnini), Asellidae, Limnoriidae. *Bulletin de la Société des Sciences Naturelles et Physiques du Maroc* **5**, 233–47, pls. 42–52.

Monod, T. (1926). Tanaidacés, Isopodes et Amphipodes. *Resultats du Voyage de 'Belgica' 1897–1899, Expedition Antarctique Belge Rapports Scientifiques, Zoologie* **4**, 1–67.

Monod, T. (1931*a*). Sur quelques Crustacés aquatiques d'Afrique (Cameroun et Congo). *Revue de Zoologie et de Botanique Africaine* **21**, 1–36.

Monod, T. (1931*b*). Tanaidacés et Isopodes subantarctique de la collection Kohl-Larsen du Senckenberg Museum. *Senckenbergiana biologia* **13**, 10–30.

Monod, T. (1931*c*). Crustacés de Syrie. In 'Les États de Syrie'. (Ed. A. Gruvel.) pp. 397–435. In Series 'Bibliothèque de la Faune des Colonies Françaises'.

Monod, T. (1933). Tanaidacea et Isopoda. In 'Mission Robert Ph. Dollfus en Égypte'. *Mémoires de l'Institut de Égyte* **21**, 161–264.

Monod, T. (1961). Sur un Isopode Asellote du genre *Bagatus* recueilli sur un poisson du Senegal. *Crustaceana* **2**, 68–77.

Monod, T. (1974). Nouvelles observations sur le genre *Bagatus* (Crustacea, Isopoda). *Bulletin du Muséum National d'Histoire Naturelle, 3^e série Zoologie* **166**, 1121–35.

Monod, T. (1975). Sur quelques Crustacés Malacostracés de l'île la Réunion. *Bulletin du Muséum National d'Histoire Naturelle, 3^e série Zoologie* **226**, 1005–33.

Moreira, P. S., and Pires, A. M. S. (1977*a*). Aspects of the breeding biology of *Janaira gracilis* Moreira and Pires (Crustacea, Isopoda, Asellota). *Boletim Instituto Oceanográfico Universidade de Sao Paulo* **26**, 181–99.

Moreira, P. S., and Pires, A. M. S. (1977*b*). *Janaira gracilis*, a new genus and species of janirid isopod from Brazil. *Crustaceana* **33**, 23–32.

Müller, F. (1892). Descriçao da *Janaira exul*, crustaceo isopode do estade de Santa Catharina. *Arquivo Museu Nacional do Rio de Janeiro* **8**, 207–20.

Müller, H.-G. (1989). Janiridae from the Caribbean Sea of N-Colombia (Crustacea: Isopoda: Asellota). *Senckenbergiana biologia* **70**, 203–7.

Müller, H.-G. (1992). Janiridae from Malaysian coral reefs, with description of two new species of *Bagatus* Nobili, 1906 and *Carpias* Richardson, 1902 (Crustacea: Isopoda: Asellota). *Mitteilungen aus dem zoologischen Museum in Berlin* **68**, 331–43.

Müller, H.-G., and Brusca, R. (1992). Validation and redescription of *Iais singaporensis* Menzies & Barnard, 1951, a commensal with *Sphaeroma triste* Heller, 1865, from a Malaysian coral reef. *Zoologischer Anzeiger* **229**, 1–84.

Naylor, E. (1972). 'British Marine Isopods'. In Series 'Synopses of the British Fauna (New Series)', Vol. 3. (Academic Press: London and New York.)

Naylor, E., and Haahtela, I. (1966). Habitat preference and interspersion of species within the super-species *Jaera albifrons* Leach (Crustacea: Isopoda). *Journal of Animal Ecology* **35**, 209–16.

Naylor, E., and Haahtela, I. (1967). Quantitative ecological distribution of the *Jaera albifrons* group of species in the Baltic. *Ophelia* **4**, 19–27.

Neave, S. A. (Ed.) (1939). 'Nomenclator Zoologicus'. In Series 'A List of Names of Genera and Subgenera in Zoology from the Tenth Edition of Linnaeus 1758 to the end of 1935'. (Zoological Society, London. Clay and Co Ltd: Bungay, Suffolk, Great Britain.)

Nicholls, G. E. (1929). Notes on freshwater Crustacea of Australia. *Victorian Naturalist* **45**, 285–95.

Nierstrasz, H. F. (1918). Alte und neue Isopoden. *Zoologische Mededelingen (Leiden)* **4**, 103–42.

Nierstrasz, H. F. (1941). Isopoda Genuina. III. Gnathiidea, Anthuridea, Valvifera, Asellota, Phreatoicidea. In 'Die Isopoden der Siboga-Expedition'. (Eds M. Weber and L. F. De Beaufort.) Chapt. 4, pp. 235–308. In Series 'Siboga Expeditie (Uitkomsten op Zoologisch, Botanisch, Oceanographisch en Geologisch Gebied verzameld in Nederlandsch Oost-Indië 1899–1900 aan boord H.M. Siboga onder commando van Luitenant ter zee Ie kl. G. F. Tydeman)', Monographie 32d. (Series Ed. M. Weber.) (E. J. Brill: Leiden.)

Nierstrasz, H. F., and Stekhoven, J. H. S. (1930). Isopoda genuina. In 'Die Tierwelt der Nord- und Ostsee'. Vol. 18, Chapt. 12, pp. 59–133.

Nobili, G. (1906). Diagnoses préliminaires de Crustacés, Décapodes et Isopodes nouveaux recueillis par M. le Dr G. Seurat aux iles Touamotou. *Bulletin du Muséum National d'Histoire Naturelle, 1^e série* **12**, 256–70.

Nobili, G. (1907). Richerche Sui Crostacei Della Polinesia. Decapodi, Stomatapodi, Anisopodi e Isopodi. *Memoirie della Reale Accademia delle Scienze di Torino, ser. 2* **57**, 351–430, pls 1–3.

Nordenstam, Å. (1930). Tanaidacea and marine Isopoda from Juan Fernandez. In 'The Natural History of Juan Fernandez and Easter Island'. (Ed. C. Skottsberg.) Vol. 3, pp. 525–52. (Almqvist and Wiksells Boktryckeri-A-B: Upsala.)

Nordenstam, Å. (1933). 'Marine Isopoda of the Families Seroloidae, Idotheidae, Pseudidotheidae, Arcturidae, Parasellidae and Stenetriidae mainly from the South Atlantic'. In Series 'Further Zoological Results of the Swedish Antarctic Expedition 1901–1903 under the Direction of Dr Otto Nordenskjöld, Vol. 3, No. 1. (Series Ed. S. Bock.) (Norstedt & Söner: Stockholm.)

Nordenstam, Å. (1946). Marine Isopoda from Professor Dr Sixten Bock's Expedition 1917–1918. *Arkiv für Zoölogi* **37A**, 1–31.

Norman, C. (1894). A month on the Trondhejm Fiord. *Annals and Magazine of Natural History, series 6* **13**, 155–64, 267–83.

Nunomura, N. (1981). Isopod crustaceans in Sado Island, the Sea of Japan. *Annual Report of the Sado Marine Biological Station, Niigata University* **11**, 43–62.

Nunomura, N. (1985*a*). Marine isopod crustaceans in the coast of Toyama Bay. *Memoirs of the National Science Museum, Tokyo* **18**, 121–39.

Nunomura, N. (1985*b*). Marine tanaid and isopod crustaceans off Kagawa Prefecture, Seto Inland Sea, Japan. *Special Publication of the Mukaishima Marine Biological Station* **1985**, 101–12.

Nunomura, N. (1991). Littoral isopod crustaceans deposited at the Toyama Science Museum. *Bulletin of the Toyama Science Museum* **14**, 27–44.

Ohlin, A. (1901). Leptostraca, Isopoda, Cumacea. In 'Arctic Crustacea collected during the Swedish Arctic Expeditions 1898 and 1899 under the Direction of Professor A. G. Nathorst. I'. *Bihang Till Kungliga Svenska Vetenskap-Akademiens Handlingar* **26**, 1–54.

Oldevig, H. (1917). Die Amphipoden, Isopoden und Cumaceen des Eisfjords. In 'Zoologische Ergebnisse der Schwedischen Expedition nach Spitzbergen 1908 unter Leitung von Professor G. Degeer'. *Bihang Till Kungliga Svenska Vetenskap-Akademiens Handlingar* **54**, 1–56.

Omer-Cooper, J. (1921). A new species of isopod (*Janiropsis parva*) from Tanning Island. *Bournemouth Natural Science Society, Proceedings* **12**, 79–82.

Ortiz, M. (1983). Guida para la identificacion de los Isópodos y Tanaidáceos (Crustacea: Peracarida), asociados a los pilotes de las Aguas Cubanas. *Revista de Investigaciones Marinas* **4**, 3–20.

Ortmann, A. E. (1900). Preliminary report on the Crustacea and Pycnogonida of the Princeton Arctic Expedition 1899. *Princeton University Bulletin* **11**, 39–40.

Ortmann, A. E. (1901). Crustacea and Pycnogonida collected during the Princeton Expedition to North Greenland. *Proceedings of the Academy of Natural Sciences of Philadelphia* **1901**, 144–68.

Ortmann, A. E. (1911). Crustacea of Southern Patagonia. In 'Reports of the Princeton University Expedition to Patagonia, 1896–1899'. Vol. 2, Zoology, Chapt. 3, pp. 635–67, pl. 48.

Pantoustier, G., and Prunus, G. (1977). Cycle biologique de l'Isopode *Jaera hopeana* dans les milieux marins et lagunaires du nord-est de la Tunsie. *Marine Biology* **43**, 361–7.

Pesce, G. L. (1979). The first microparasellid from subterranean waters of Iran, *Microcharon raffaellae* n. sp. (Crustacea, Isopoda). *Vie et Milieu* **28–29**, 237–45.

Pesce, G. L. (1981). *Microcharon ullae* n. sp., a microparasellid from subterranean waters of Rhodes, Greece (Isopoda: Asellota). *Fragmenta Balcanica Musei Macedonici Scientiarum Naturalium* **11**, 57–62.

Pesce, G. L., and Argano, R. (1979). Asellota d'eau douce de Grece (Crustacea: Isopoda). *Biologia Gallo-Hellenica* **8**, 129–34.

Pesce, G. L., and Galassi, D. M. P. (1988*a*). The genus *Microcharon* Karaman in Italy: an update and description of three new species (Crustacea Isopoda: Microparasellidae). *Stygologia* **4**, 249–61.

Pesce, G. L., and Galassi, D. M. P. (1988*b*). Microparasellids of Spain (Crustacea Isopoda: Janiroidea). *Stygologia* **4**, 307–31.

Pesce, G. L., and Galassi, D. M. P. (1990). Netherlands Biospeleological Explorations in Turkey. 2. First records of the family Microparasellidae in Turkey, and description of two new species of the genus *Microcharon* Karaman (Crustacea Isopoda: Janiroidea). *Stygologia* **5**, 173–81.

Pesce, G. L., and Tetè, P. (1978*a*). Un noveau Microparasellide des eaux souterraines phreatiques de l'Italie: *Microcharon arganoi* n. sp. (Crustacé: Isopoda). In 'Contribution à la Connaissance de la Faune des Eaux Souterraines de l'Italie Centre-Meridionale'. *International Journal of Speleology* **9**, 115–23.

Pesce, G. L., and Tetè, P. (1978*b*). Recherches en Afrique de l'Institut de Zoologie de l'Aquila (Italie). 1. Microparadellides d'Algerie (Crustacé: Isopoda). *Revue de Zoologie Africaine* **92**, 992–1002.

Pfeffer, G. (1887). Die Krebse von Snach der Ausbeute der Deutschen Station 1882–83. 1. Teil. *Jahrbuch der Hamburgischen Wissenschaftlichen Austalten, Hamburg* **4**, 1–110, 7 pls.

Pillai, N. K. (1954). A preliminary note on the Tanaidacea and Isopoda of Travancore. *Bulletin of the Central Research Institute, University of Kerala, India, Series C, Natural Sciences* **3**, 1–21.

Pires, A. M. S. (1980). Revalidation and redescription of the genus *Carpias* Richardson, 1902 (Isopoda, Asellota). *Crustaceana* **39**, 95–103.

Pires, A. M. S. (1981*a*). *Carpias harrietae* (Isopoda, Asellota), a new species from Florida. *Crustaceana* **40**, 206–12.

Pires, A. M. S. (1981*b*). Ecological study on littoral and infralittoral isopods from Ubatuba, Brazil. *Boletim Instituto Oceanográfico Universidade de Sao Paulo* **30**, 27–40.

Pires, A. M. S. (1982). Taxonomic revision of *Bagatus* (Isopoda, Asellota) with a discussion of ontogenetic polymorphism in males. *Journal of Natural History* **16**, 227–59.

Poore, G. C. B., and Just, J. (1990). *Pseudojanira investigatoris*, new species, from Southern Australia —second species in the Pseudojaniridae (Isopoda, Asellota) with new morphological information and interpretations. *Journal of Crustacean Biology* **10**, 520–27.

Prunus, G. (1963). Sur l'existence d'un dimorphisme chez les mâles d'une population de *Jaera marina syei* Bocquet (Isopode, Asellote). *Comptes Rendus de l'Academie des Sciences, Paris* **256**, 2043–5.

Radu, V. G. (1979). Observations sur *Jaera sarsi* Valkanov (Isopoda, Asellota) des eaux roumaines du Danube. *Travaux du Muséum d'Histoire Naturelle Grigore Antipa* **20**, 177–88.

Rathbun, M. J. (1905). Fauna of New England. 5. List of the Crustacea. *Occasional Papers of the Boston Society of Natural History* **7**, 1–117.

Rathke, H. (1837). Beitrag zur Fauna der Krym. *Mémoires de l'Academie Impériale des Sciences, St Petersbourg* **3**, 388–90.

Rathke, H. (1843). Beitrag zur Fauna Norwegens. I. Crustacea. *Nova Acta Academia Caes. Leopoldina Carol. Naturae Curiosorum* **20**, 1–32, tbl. 1–6.

Reboreda, P., and Otero, J. C. (1990). Distribucion de las especies del genero *Jaera* (Isopoda, Asellota) en las Rias del Ferrol y Areas-Betanzos (NW de la Peninsula Iberica). *Thalassas* **7**, 73–7.

Renaud-Mornant, J., and Coineau, N. (1978). Étude anatomique des isopodes interstitiels, *Angeliera phreaticola* Chappuis et Delamare, 1952. Données générales. *Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, Paris, série D* **286**, 1249–52.

Renault, O. (1958). Note sur la morphologie et le développement de *Jaera nordmanni* (Rathke) Isopode Asellote. *Archives de Zoologie Expérimentale et Générale, Notes et Revue* **96**, 63–70.

Richardson, H. (1899). Key to the isopods of the Pacific Coast of North America, with descriptions of twenty-two new species. *Proceedings of the United States National Museum* **21**, 815–69.

Richardson, H. (1900). Synopsis of North American Invertebrates. VIII. The Isopoda, Part II. Asellota, Oniscoidea, Epicaridea. *American Naturalist* **34**, 295–309.

Richardson, H. (1901). Key to the Isopoda of the Atlantic coast of North America with descriptions of new and little known species. *Proceedings of the United States National Museum* **23**, 493–579.

Richardson, H. (1902). The marine and terrestrial isopods of the Bermudas with descriptions of new genera and species. *Transactions of the Connecticut Academy of Arts and Sciences, New Haven* **11**, 277–310.

Richardson, H. (1904*a*). Contribution to the natural history of the Isopoda. *Proceedings of the United States National Museum* **27**, 1–89.

Richardson, H. (1904*b*). Isopod crustaceans of the northwest coast of North America. *Proceedings of the United States National Museum* **27**, 657–71.

Richardson, H. (1904*c*). Isopod crustaceans of the northwest coast of North America. In 'The Harriman Alaska Expedition. Crustacea'. Chapt. 10, pp. 213–30.

Richardson, H. (1905*a*). Isopods from the Alaska salmon investigations. *Bulletin of the U.S. Bureau of Fisheries* **24**, 209–21.

Richardson, H. (1905*b*). A monograph on the isopods of North America. *Bulletin of the United States National Museum* **54**, 1–717.

Richardson, H. (1906). Isopodes (Premiere Mémoire). In 'Expedition Antarctique Française (1903–1905). Documents scientifiques de Science naturelle. Crustacés'. pp. 1–22.

Richardson, H. (1908). Some new Isopoda of the superfamily Aselloidea from the Atlantic Coast of North America. *Proceedings of the United States National Museum* **35**, 71–86.

Richardson, H. (1909). Isopods collected in the Northwest Pacific by the U.S. Bureau of Fisheries Steamer 'Albatross' in 1906. *Proceedings of the United States National Museum* **37**, 75–129.

Richardson, H. (1910). Marine isopods collected in the Philippines by the United States Fisheries Steamer 'Albatross' in 1907–1908. *Documents of the Bureau of Fisheries, Washington* **736**, 1–44.

Richardson, H. (1911*a*). Les crustacés du 'Travailleur' et du 'Talisman', formes nouvelles. *Bulletin du Muséum National d'Histoire Naturelle, 1^e série* **7**, 518–34.

Richardson, H. (1911*b*). Descriptions of a new genus and species of Janiridae from the Northwest Pacific. *Proceedings of the United States National Museum* **40**, 633–5.

Richardson, H. (1913). Crustacés Isopodes. Les Isopodes recueillis au cours de la campagne du 'Pourquoi Pas' de 1908 à 1910. In 'Expedition J. Charcot. Deuxième Expédition Antarctique Française 1908–1910'. (Ed. J. Charcot.) pp. 1–24.

Ridley, M. (1983). 'The explanation of Organic Diversity. The Comparative Method and Adaptations for Mating.' (Clarendon Press: Oxford, Great Britain.)

Ringuelet, R. A. (1981). Presencia del isópodo dulciaguicola *Fritzianira exul* (Müller) en la ribera occidental del Rio de la Plata. *Limnobios* **2**, 88.

Roberts, P. C. (1975). *Heterias petrensis*, a new species of freshwater isopod from Tasmania (Family Janiridae, Tribe Asellota). *Papers and Proceedings of the Royal Society of Tasmania* **109**, 21–31.

Rotramel, G. L. (1972). *Iais californica* and *Sphaeroma quoyanum*, two symbiotic isopods introduced to California (Isopoda, Janiridae, Sphaeromatidae). In 'Studies on Peracarida'. *Crustaceana* (Suppl. 3), 193–7.

Rotramel, G. L. (1975). Observations on the commensal relations of *Iais californica* (Richardson, 1904) and *Sphaeroma quoyanum* H. Milne Edwards, 1840 (Isopoda). *Crustaceana* **28**, 247–56.

Sabater, F., and de Manuel, J. (1988). Interstitial Isopoda of the River Ter (Catalonia, N.E. Spain) and description of two new species, *Microcharon margalefi* n. sp. and *Proasellus phreaticus* n. sp. *Stygologia* **4**, 267–78.

Sars, G. O. (1872). Undersøgelser over Hardangerfjordens Fauna. *Forhandlinger I Videnskabs-Selskabet I Kristiania* **1871**, 245–86.

Sars, G. O. (1883). Oversigt af Norges Crustaceer med forelúbige Bemaerkninger over de nye eller mindre bekjendte Arter. I. (Podophthalmata–Cumacea–Isopoda–Amphipoda). *Forhandlinger I Videnskabs-Selskabet I Kristiania* **1882**, 1–124.

Sars, G. O. (1897*a*). 'Isopoda. Part V, VI. Idotheidae, Arcturidae, Asellidae, Ianiridae, Munnidae'. In Series 'An Account of the Crustacea of Norway with Short Descriptions and Figures of All the Species'. Vol. 2. (Bergen Museum: Bergen, Norway.) (Plates XXXIII–XLIX.)

Sars, G. O. (1897*b*). On some additional Crustacea from the Caspian Sea. *Annales du Musée Zoologique Academie Impériale des Sciences, St Petersbourg* **2**, 273–305.

Sayce, O. A. (1900). *Janirella*, a new genus of Isopoda from fresh-water, Victoria. *Proceedings of the Royal Society of Victoria* **13**, 124–30, pls xviii.

Schiecke, U. (1973). 'Ein Beitrag zur Kenntnis der Systematik, Biologie und Autökologie mariner Peracarida (Amphipoda, Isopoda,Tanaidacea) des Golfes von Neapel'. Dissertation zur Erlangung der Doktorwürde der Mathematischen, Naturwissenschaftlichen Fakultät der Christian. Albrechts, Universität Kiel, 408, 91 figs pp.

Schiecke, U., and Fresi, E. (1970). A new interstitial asellote isopod from the island of Ischia (Bay of Naples), *Microjanira dentifrons* n. g., n. sp. *Crustaceana* **18**, 241–50.

Schotte, M., Heard, R. W., and Kensley, B. (1991). Studies on the Crustacea of the Turks and Caicos Islands, British West Indies. III. Records of marine Isopoda from Pine Cay, Fort George Cay, and adjacent waters. *Gulf Research Reports* **8**, 252–8.

Schultz, G. A. (1969). 'How to Know the Marine Isopod Crustaceans.' (Wm. C. Brown Company: New York.)

Schultz, G. A. (1976). Species of Asellotes (Isopoda: Paraselloidea) from Anvers Island, Antarctica. In 'Biology of the Antarctic Seas. VI'. (Ed. D. L. Pawson.) *Antarctic Research Series* **26**, 1–35.

Schulz, E. von. (1953). *Jaera petiti* nov. spec., ein neuer isopode von der Französischen Mittelmeerkuste (I). *Vie et Milieu* **4**, 59–64.

Schulz, E. von. (1954). *Angeliera phreaticola* auf Ischia. Ein Beitrag zur Kenntnis und Verbreitung der Microparasellidae. *Kieler Meeresforschungen* **10**, 253–60.

Serban, E. (1964). Nouvelles données sur les Microparasellidae (Isopoda) de Roumanle. *Vie et Milieu* **15**, 341–64.

Siebenaller, J., and Hessler, R. R. (1977). The Nannoniscidae (Isopoda, Asellota): *Hebefustis* n. gen. and *Nannoniscoides* Hansen. *Transactions of the San Diego Society of Natural History* **19**, 17–44.

Siewing, T. (1959). *Angeliera xarifae*, ein neuer Isopode aus dem Küstengrundwasser der Insel Abd el-Kuri (Gulf von Aden). *Zoologischer Anzeiger* **163**, 365–70.

Sivertsen, E., and Holthuis, L. B. (1980). The marine isopod Crustacea of the Tristan da Cunha Archipelago. In 'Results of the Norwegian Scientific Expedition to Tristan de Cunha 1937–1938'. *Gunneria* **35**, 1–128.

Sket, B. (1982). New Protojaniridae (Isopoda, Asellota) from Sri Lanka and some corrections of the taxonomy of the family. *Bioloski Vestnik (Ljubljana)* **30**, 127–42.

Sket, B. (1990). Isopoda (Crustacea: Isopoda: *Microcharon*, *Jaera*, *Proasellus*) and other fauna in hypogean waters of southern Cyprus. *International Journal of Speleology* **19**, 39–50.

Smith, S. I. (1876). Crustacea. In 'Contribution to the Natural History of Kerguelen Island Made in Connection with the U.S. Transit-of-Venus Expedition, 1874–1875'. *Bulletin of the United States National Museum* **3**, 1–122.

Solignac, M. (1981). Isolating mechanisms and modalities of speciation in the *Jaera albifrons* species complex (Crustacea, Isopoda). *Systematic Zoology* **30**, 387–405.

Spasski, N. N. (1961). The littoral of the southern coast of Kamchatka. *Exploration of the Far-Eastern Seas of the USSR* **7**, 261–311. (In Russian.)

Spooner, G. M. (1959*a*). New members of the British marine bottom fauna. *Nature* **183**, 1695–6.

Spooner, G. M. (1959*b*). The occurrence of *Microcharon* in the Plymouth offshore bottom fauna, with description of a new species. *Journal of the Marine Biological Association of the United Kingdom* **38**, 57–63.

Stafford, B. E. (1913). Studies in Laguna Beach Isopoda. II B. *Pomona College Journal of Entomology and Zoology* **5**, 161–72, 182–8.

Staiger, H., and Bocquet, C. (1956). Les chromosomes de la super-espéce *Jaera marina* et de quelques autres Janiridae (Isopodes, Asellotes). *Bulletin Biologique de France et Belgique* **90**, 1–32.

Stebbing, T. R. R. (1893). 'A History of Crustacea – Recent Malacostraca.' In Series 'The International Scientific Series', No. 74. (Kegan Paul, Trench, Trübner & Co. Ltd.: London.)

Stebbing, T. R. R. (1900). On some crustaceans from the Falkland Islands, collected by Mr Rupert Vallentin. *Proceedings of the Zoological Society of London* **1900**, 517–68.

Stebbing, T. R. R. (1905). South African Crustacea, Part III. *Marine Investigations in South Africa, Department of Agriculture, Cape Town* **4**, 21–120.

Stebbing, T. R. R. (1910*a*). Isopoda from the Indian Ocean and British East Africa. In 'The Percy Sladen Trust Expedition, Indian Ocean 1905, III(6)'. *Transactions of the Linnean Society of London (Zoology)* **14**, 83–122.

Stebbing, T. R. R. (1910*b*). On the Crustacea Isopoda and Tanaidacea. In 'Reports on the Marine Biology of the Sudanese Red Sea. XIV'. *Journal of the Linnean Society of London, Zoology* **31**, 215–30.

Stebbing, T. R. R. (1912). On the Crustacea Isopoda of the 'Porcupine' Expedition. *Abstracts and Proceedings of the Zoological Society of London* **112**, 42.

Steele, D. H., and Steele, V. J. (1972). The biology of *Jaera* spp. (Crustacea Isopoda) in the north-western Atlantic. 1. *Jaera ischiosetosa*. *Canadian Journal of Zoology* **50**, 205–11.

Stephensen, K. (1913). Account of the Crustacea and the Pycnogonida collected by Dr V. Nordmann in the summer of 1911 from northern Stromfjord and Giesecke Lake in West Greenland. II. *Meddelelser om Grönland* **51**, 53–77.

Stephensen, K. (1927). Crustacea from the Auckland and Campbell Islands. In 'Papers from Dr Th. Mortensen's Pacific Expedition 1914–1916'. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening Kobenhavn* **83**, 289–390.

Stephensen, K. (1936). Crustacea varia. The Godthaab Expedition, 1928. *Meddelelser om Grönland* **80**, 1–38.

Stephensen, K. (1943). Leptostraca, Mysidacea, Cumacea, Tanaidacea, Isopoda, and Euphausiacea. *Meddelelser om Grönland* **121**, 1–82.

Stephensen, K. (1947). Tanaidacea, Isopoda, Amphipoda and Pycnogonida. *Scientific Results of the Norwegian Antarctic Expedition, 1927–1928* **27**, 1–90.

Stephensen, K. (1948). Storkrebs IV. Ringkrebs. 3. Tanglus (Marine Isopoder) og Tanaider. In 'Danmarks Fauna'. Vol. 53, pp. 1–187. (G. E. G. Gads Forlag: København.)

Stimpson, W. (1853). Synopsis of the marine Invertebrata of Grand Manan, or the region about the mouth of the Bay of Fundy, New Brunswick. *Smithsonian Contributions to Knowledge* **6**, 1–66.

Stock, J. H. (1977). Microparasellidae (Isopoda, Asellota) from Bonaire with notes on the origin of the family. *Studies on the Fauna of Curaçao and other Caribbean Islands* **51**, 69–91.

Stock, J. H. (1985). Discovery of interstitial Isopoda of the family Microparasellidae in inland waters of Australia. *Stygologia* **1**, 91–100.

Strouhal, H. (1942). Vorläufige Mitteilung über die von M. Beier in Nordwestgriechenland gesammelten Asseln. *Zoologischer Anzeiger* **138**, 145–62.

Strouhal, H. (1954). Zoologische Studien in West-Griechenland. II, Teil Süsswasser-Isopoden. 18. Beitrag zur Isopodenfauna des Balkans. *Sitzungsberichte der Österreichischen Akademie der Wissenschaften Mathematisch-Naturwissenschaftliche Klasse, Abteilung I* **163**, 11–44.

Svavarsson, J. (1982). *Limnoria borealis* (Isopoda, Flabellifera) and its commensal, *Caecijaera borealis* (Isopoda, Asellota), found in Icelandic waters. *Sarsia* **67**, 223–6.

Svavarsson, J. (1987). Re-evaluation of *Katianira* in Arctic waters and erection of a new family, Katianiridae (Isopoda: Asellota). *Journal of Crustacean Biology* **7**, 704–20.

Sye, C. G. (1887). Beiträge zur Anatomie und Histologie von *Jaera marina*. Inaug.-Dissertation, Universität Kiel, 6–43 pp.

Taberner, R. (1982). Redescripción de *Fritzianira exul* (Müller 1892) (Isopoda, Janiridae). *Physis* **41**, 19–23.

Tattersall, W. M. (1921). Crustacea. Part VI. Tanaidacea and Isopoda. In 'British Antarctic "Terra Nova" Expedition 1910. Natural History Report, Zoology'. Vol. 3(8), pp. 191–258, pls 1–11. (British Museum—Natural History: London.)

Thielemann, M. (1910). Beiträge zur Kenntnis der Isopodenfauna Ostasiens. In 'Beiträge zur naturgeschichte Ostasiens'. (Ed. F. Dolfein.) *Abhandlungen der mathematique-physique Klasse der K. Bayer. Akademie der Wissenschaften* **2** (Supplement 3), 1–109.

Thomson, G. M. (1888). Notes on, and recent additions to the New Zealand crustacean fauna. *Transactions of the New Zealand Institute* **21**, 259–68.

Thomson, G. M., and Chilton, C. (1886). Critical list of the Crustacea Malacostraca of New Zealand. *Transactions and Proceedings of New Zealand Institute, Zoology* **18**, 141–59.

Valkanov, A. (1936). Notizen über die Brackwässer Bulgariens. 2. Versuch einer hydrographischen und biologischen Erforschung derselben. *Annuaire de l'Université de Sofia, Faculté physico-mathematique* **32**, 209–341. (In Bulgarian with German summary.)

Valkanov, A. (1938). Über die europäischen Vertreter der Gattung *Jaera* Leach, 1913 (Isopoda genuina). *Annuaire de l'Université de Sofia, Faculté physico-mathematique* **34**, 53–78. (In Bulgarian with German summary.)

Vanhöffen, E. (1914). Die Isopoden der Deutschen Südpolar Expedition 1901–1903. *Deutschen Südpolar Expedition, No. 15, Zoologie* **7**, 447–598.

Van Name, W. G. (1942). A second supplement to the American land and freshwater isopod Crustacea. *Bulletin of the American Museum of Natural History* **80**, 299–329.

Verhoeff, K. W. (1943). Zur Morphologie, Ökologie und Systematik von *Sphaeroma*, *Europosphaera* und *Jaera*. *Zeitschrift für Morphologie und Ökologie der Tiere* **40**, 276–90.

Verhoeff, K. W. (1949). Zur Kenntnis der maritimen Isopoden. Gattung *Sphaeroma*, die Incurvation deselben und *Jaera* als Gast von *Sphaeroma*. 81. Isopoden Aufsatz. *Archiv für Hydrobiologie* **42**, 395–422.

Verrill, A. E. (1873). Results of recent dredging expeditions on the coast of New England. *American Journal of Sciences and Arts, series 3* **6**, 435–41.

Verrill, A. E. (1874*a*). Results of recent dredging expeditions on the coast of New England. *American Journal of Sciences and Arts, series 3* **7**, 38–46, 131–8, 405–14, 498–505, pls 4, 5.

Verrill, A. E. (1874*b*). Explorations of Casco Bay by the U.S. Fish Commission in 1873. *Proceedings of the American Association for the Advancement of Science, Portland Meeting* **1873**, 340–95, pls 1–6.

Veuille, M. (1976*a*). Biogeography of the *Jaera albifrons* superspecies (Isopoda, Asellota) on the Atlantic coast of Canada. *Canadian Journal Zoology* **54**, 1235–41.

Veuille, M. (1976*b*). Systématique et affinités continentales des *Jaera* (Isopodes, Asellotes) de l'îles de Florés (Açores). *Bulletin du Muséum National d'Histoire Naturelle, 3^e série Zoologie* **415**, 1327–38.

Veuille, M. (1978*a*). Biologie de la reproduction chez *Jaera* (Isopode, Asellote). I. Structure et fonctionnement des pièces copulatrices mâles. *Cahiers de Biologie Marine* **19**, 299–308.

Veuille, M. (1978*b*). Biologie de la reproduction chez *Jaera* (Isopode, Asellote). II. Évolution des organes reproducteurs femelles. *Cahiers de Biologie Marine* **19**, 385–95. (In French.)

Veuille, M. (1979). L'évolution du genre *Jaera* Leach (Isopodes; Asellotes) et ses rapports avec l'histoire de la Méditerranée. *Bijdragen tot de Dierkunde* **49**, 195–218.

Veuille, M., and Kocatas, A. (1979). Les *Jaera* (Isopodes, Asellotes) des côtes de Turquie, étude comparative et biogéographique. *Vie et Milieu, série A/B* **28–29**, 597–611.

Wägele, J. W. (1983). On the origin of the Microcerberidae (Crustacea: Isopoda). *Zeitschrift für Zoologische Systematik und Evolutionsforschung* **21**, 249–62.

Wägele, J. W. (1989). Evolution und phylogenetisches System der Isopoda. Stand der Forschung und neue Erkenntnisse. *Zoologica* **140**, 1–262.

Wagner, H. P. (1990). *Jehaia stocki* n. g., n. sp., a new interstitial janiroid isopod from the Dominican Republic, Hispaniola (Crustacea, Isopoda). *Beaufortia* **41**, 187–93.

Walker, A. O. (1898). Crustacea collected by W. A. Herdman, F.R.S., in Puget Sound, Pacific Coast of North America, September, 1897. *Transactions of the Liverpool Biological Society* **12**, 268–87, pls 15, 16.

Wells, J. B. J. (1963). On some new and rare Crustacea from Northern Ireland. *Annals and Magazine of Natural History, series 13* **6**, 85–96.

Whitelegge, T. (1889). 'Marine and Fresh-water Invertebrate Fauna of Port Jackson and Neighbourhood.' (The Royal Society of New South Wales: Sydney, Australia.)

Williams, W. D. (1968). 'Australian Freshwater Life—The Invertebrates of Australian Inland Waters.' 1st Edn. (Sun Books: Melbourne.)

Williams, W. D. (1974). Freshwater Crustacea. In 'Biogeography and Ecology in Tasmania'. (Ed. W. D. Williams.) pp. 63–112. In Series 'Monographs on Biology', No. 25. (Dr. W. Junk, B.V.: The Hague.)

Williams, W. D. (1980). 'Australian Freshwater Life—The Invertebrates of Australian Inland Waters.' 2nd Edn. (The MacMillan Company of Australia Pty Ltd: Melbourne.)

Williams, W. D. (1981). The Crustacea of Australian inland waters. In 'Ecological Biogeography of Australia'. (Ed. A. Keast.) pp. 1101–38. In Series 'Monographs on Biology', Vol. 41, No. 2. (W. Junk: The Hague/Boston.)

Wilson, G. D. F. (1981). Taxonomy and postmarsupial development of a dominant deep-sea eurycopid isopod (Crustacea). *Proceedings of the Biological Society of Washington* **94**, 276–94.

Wilson, G. D. F. (1985). The systematic position of the ilyarachnoid Eurycopidae (Crustacea, Isopoda, Asellota). Ph.D. Dissertation, University of California, Scripps Institution of Oceanography, La Jolla, 403 pp.

Wilson, G. D. F. (1986*a*). Evolution of the female cuticular organ in the Asellota (Crustacea, Isopoda). *Journal of Morphology* **190**, 297–305.

Wilson, G. D. F. (1986*b*). Pseudojaniridae (Crustacea: Isopoda), a new family for *Pseudojanira stenetrioides* Barnard, 1925, a species intermediate between the asellote superfamilies Stenetrioidea and Janiroidea. *Proceedings of the Biological Society of Washington* **99**, 350–8.

Wilson, G. D. F. (1987). The road to the Janiroidea: comparative morphology and evolution of the asellote isopod crustaceans. *Zeitschrift für Zoologische Systematik und Evolutionsforschung* **25**, 257–80.

Wilson, G. D. F. (1989). A systematic revision of the deep-sea subfamily Lipomerinae of the isopod crustacean family Munnopsidae. *Bulletin of the Scripps Institution of Oceanography* **27**, 1–138.

Wilson, G. D. F. (1991). Functional morphology and evolution of isopod genitalia. In 'Crustacean Sexual Biology'. (Eds R. T. Bauer and J. W. Martin.) Chapt. 13, pp. 228–45. (Columbia University Press: New York/Oxford.)

Wilson, G. D. F. (1994). A phylogenetic analysis of the isopod family Janiridae (Crustacea). *Invertebrate Taxonomy* **8**, 749–66.

Wilson, G. D. F., and Hessler, R. R. (1980). Taxonomic characters in the morphology of the genus *Eurycope* (Isopoda, Asellota) with a redescription of *E. cornuta* Sars, 1864. *Cahiers de Biologie Marine* **21**, 241–63.

Wilson, G., and Hessler, R. R. (1981). A revision of the genus *Eurycope* (Isopoda, Asellota) with descriptions of three new genera. *Journal of Crustacean Biology* **1**, 401–23.

Wilson, G. D. F., Kussakin, O. G., and Vasina, G. S. (1989). A revision of the genus *Microprotus* Richardson with descriptions of 2 new species, *M. acutispinatus* and *M. lobispinatus* (Asellota, Isopoda, Crustacea). *Proceedings of the Biological Society of Washington* **102**, 339–61.

Winkler, H. (1992). *Neoectias chilense*, a new janirid genus and species from Chile (Isopoda, Asellota, Janiridae). *Zoologischer Anzeiger* **228**, 174–81.

Wolff, T. (1962). The systematics and biology of bathyal and abyssal Isopoda Asellota. *Galathea Report* **6**, 1–320.

Wolff, T. (1965). *Mictosoma* nov. nom. pro *Schistosoma* Hansen, 1916, and the spelling of certain janirid names (Isopoda). *Crustaceana* **9**, 319–20.

Zirwas, C. (1910). Die Isopoden der Nordsee. Doctoral Dissertation, Königlichen Christian-Albrechts Universität Kiel, 1–43 pp. (Verlag Schmidt und Klaunig.)

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