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Synopses of the British Fauna
No. 3

BRITISH MARINE ISOPODS

Keys and Notes for the Identification of the Species

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Foreword

The Synopses of the British Fauna published for the Linnean Society by Academic Press are working field and laboratory pocket-books designed to meet the needs of amateur naturalists, Sixth-Form pupils and undergraduates, and also be of value to professional zoologists. All are written by specialists in their own fields and this *Synopsis*, *British Marine Isopods* is no exception. The Linnean Society is grateful to authors who have given their knowledge, time and services to the Society and so have assisted in keeping the price of each *Synopsis* as low as possible. Indeed, all regret that the *Synopses* have to be priced as high as they are, and every effort is made to keep the price down without sacrificing the standard of production.

The format of this *Synopsis* is similar to that of the previous two in the *New Series*. The cover is waterproofed and there are spaces deliberately left in the text for the owner's field notes. Unfortunately the spaces are rather limited in some places and indeed might even appear non-existent. This is to prevent the Synopsis exceeding pocket-book dimensions and so inflating the retail price.

The Society welcomes suggestions and comments so that the future *Synopses* maintain the high academic standard coupled with the maximum degree of usefulness in the field and laboratory set by the early numbers in the *New Series*. These pocket-books will then continue to fill the large gap between specialist monographs and the more popular field-texts.

A number of authors have promised the Society manuscripts upon different groups of animals and the Society looks forward to receiving and publishing them in the near future.

DORIS M. KERMACK,
Editorial Secretary, Linnean Society

A Synopsis of the British Marine Isopods

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CONTENTS

Introduction

The Isopoda are a ubiquitous order of the Class Crustacea. Representatives occur in the marine environment from the littoral to abyssal zones, others occur in estuaries and in freshwaters and one suborder, the Oniscoidea, are the only crustacean group to have become completely terrestrial in habit. Adaptive radiation in the group is spectacular, ranging from stilt-legged forms living on soft abyssal mud, and small attenuate species in the interstitial fauna of coastal sand, to sphaeromids and some woodlice which are capable of rolling into a tight ball. The limnoriids are an economically important group which bore into marine timbers, and a whole range of families in more than one suborder have parasitic representatives. Many isopods show extreme sexual dimorphism as adults and some, particularly the gnathiids and epicarideans have developmental stages which are very different in form and habit from the adults.

The isopods considered in this synopsis are those recorded from British coasts, primarily in the intertidal or littoral zone. The littoral zone is here taken to comprise the area of shore between the upper and lower limits of tides or waves. The species included, therefore, are not only those adapted to intertidal habitats but some predominantly sublittoral species which are also occasionally exposed on very low tides or washed ashore among detached algae. Entirely sublittoral and terrestrial forms are not considered in detail, but some reference to them is made and they are included in the key to suborders and families (see p. 14).

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General Structure

Isopods are typically dorso-ventrally flattened crustaceans without a carapace (Fig. 1). The body is divided into a *cephalon* (head) which normally incorporates one true peraeon somite with its associated appendages (*maxillipedes*), a *peraeon* (thorax) of 7 somites (except in the Gnathiidea) and a *pleon* (abdomen) of 6 somites. Some or all of the pleon somites may be fused with the terminal *telson* forming a *pleotelson.* The cephalon bears a pair of *antennules* and a pair of usually larger *antennae,* each consisting of a basal *peduncle* and distal *flagellum,* followed by ventral *mandibles, maxillules* and *maxillae.* All the cephalic mouthparts (Fig. 2) are usually shielded below by a pair of *maxillipedes,* the appendages of the first true peraeon somite which is fused with the head. The mouth opening is bordered anteriorly by the *labrum,* posteriorly by the bilobed *paragnath* and laterally by the asymmetrical *mandibles.* The last appendages vary in structure from family to family, particularly with regard to the feeding method. In herbivorous forms such as *Idotea,* each consists of a ventral incisor process, a lacinia mobilis, a row of toothed spines and a dorsal molar process (Fig. 2A). The carnivorous genus *Eurydice* has only a slender, leaf-like molar process, associated with the habit of bolting food rather than chewing it. Several groups possess a lateral mandibular palp, but this structure is not present in all. The eyes are sessile, not stalked as in crabs, though they may be on immovable lateral projections of the head (*peduncles*).

Each of the 7 somites of the peraeon bears a pair of uniramous *peraeopods* (walking legs) which are usually more or less alike (hence "Isopoda"), except in the Arcturidae. The peraeopods each consist of 7 *articles* of which the small and indistinct proximal *coxa,* followed by the elongate article referred to as the *basis,* comprise the protopod or stem from which the exopod and endopod arise in the primitive crustacean biramous limb. The exopod is lost in isopod peraeopods so the remaining articles are those of the endopod; they are the *ischium, merus, carpus, propus* and *dactyl.* Extending laterally from the coxae at the articulations between the body and the limbs are *coxal plates* (Fig. 1) which are often visible from above at the sides of the dorsal *tergal plates.* Ovigerous females bear *oöstegites* (Fig. 2E) at the inner bases of some of the anterior peraeopods; these are thin lamellae which enclose the embryos in a brood chamber roofed over by the ventral *sternal plates.* In males, paired penes (genital apophyses) project backwards from near the midline of peraeon somite 7 (Fig. 3B).

The pleonal appendages take the form of 5 pairs of biramous respiratory *pleopods* and one pair of uropods. In most families the male pleopod 2 usually bears an *appendix masculina* (Fig. 3C) on the inner border of each member of the pair of limbs. In females of some asellotan families pleopods 1 are absent and pleopods 2 fuse to form a large plate-like *operculum* which covers the remaining pleopods. In males of these families pleopods 1 are modified as a *praeoperculum* which combines with pleopods 2 to form a copulatory structure (Fig. 3A). The uropods are typically biramous but may be uniramous in both sexes of some species and in the males of others. They may be terminal or subterminal with articles cylindrical (Fig. 3A), lateral and flattened (Fig. 1) or ventral and hinged laterally (Fig. 3B), depending upon the suborder to which the animal belongs.

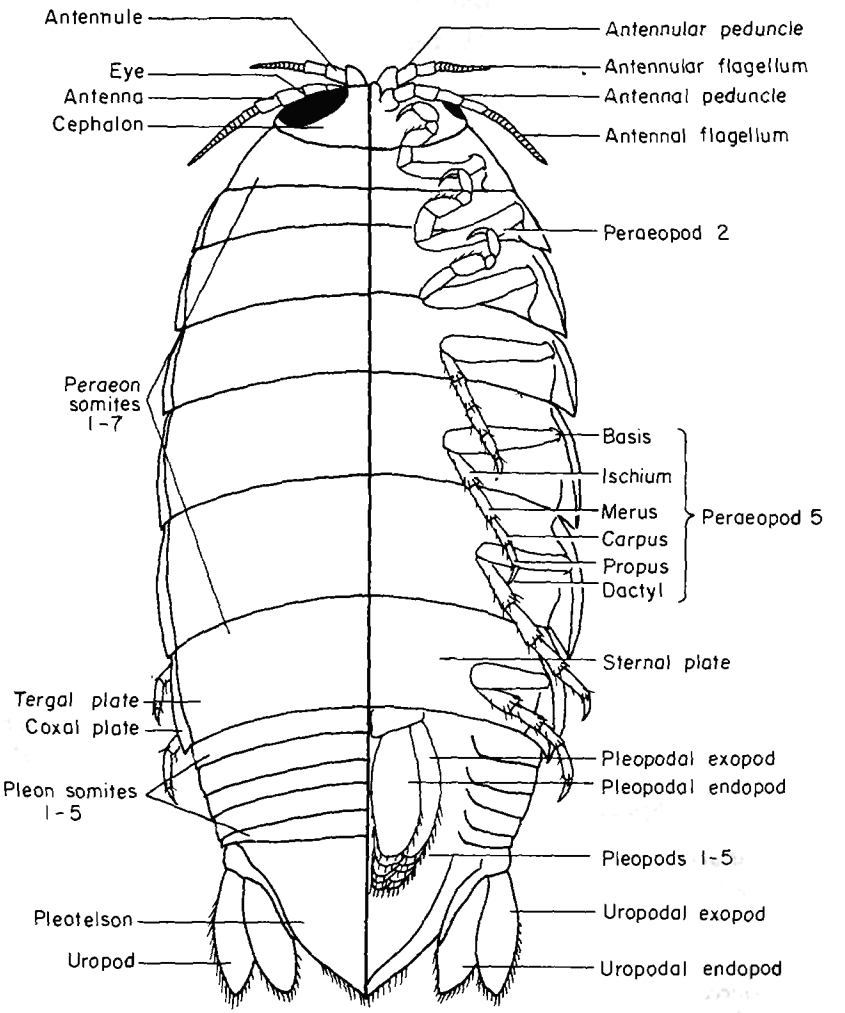


Fig. 1. Schematic diagram of a flabelliferan isopod: left half, dorsal surface; right half, ventral surface.

Biology

Life History

Those littoral isopods which have been studied have lifespans ranging from 1 to 2½ years, with males of some species surviving for up to a year longer than females. In many, but not all forms, release of young takes place in the warmer months of the year, the precise timing and duration of release varying in relation to the geographical distribution of the species. Lower latitude species such as *Dynamene bidentata*, *Campecopea hirsuta* and *Sphaeroma serratum*, which reach the northern limits of their distribution on our southwest coasts, release their young over a short period of about two months in summer (Holdich, 1968b; Harvey, 1968, 1969). On the other hand, species such as *Idotea emarginata* and *Sphaeroma rugicauda*, which range into higher latitudes, release their young over a much more prolonged period from April or May to October (Naylor, 1955d; Harvey, 1969). This difference in breeding pattern has also been reported by Jones (1970) in two closely related littoral species of *Eurydice*. The more northerly ranging *E. pulchra* released young from June to October whereas *E. affinis*, which reaches its northern limit in south-west Britain, released young over a 3 month period from July to September. In the wood-boring genus *Limnoria* three species are recorded in Britain, each with a characteristic pattern of breeding which correlates with its over-all geographical distribution (Eltringham & Hockley, 1961; Jones, 1963). *L. lignorum* is a boreal form reaching its southern limit in southern England, where it breeds particularly in winter from November to May or June. *L. quadripunctata*, on the other hand, is a lower latitude, temperate species breeding mainly from April to December, while *L. tripunctata* is a temperate-tropical form which in Britain breeds predominantly where artificial warming occurs, such as near power station effluents.

In free living isopods the sexes first come together for breeding at pre-copula, when males carry females for a short period until the moult at which copulation occurs. So far as can be judged from the literature, copulation has not been observed directly, but some details can be inferred from the secondary sexual characteristics. Sperm are transferred in spermatophores, which are often seen in *Eurydice*. These emerge from the paired penes situated in the mid-ventral region of peraeon somite 7 of the male, and are presumably transferred to the female genital ducts on peraeon somite 5 by the appendix masculina or praeoperculum (see p. 2). Some species have no appendix masculina, and their mode of copulation is open to even more speculation. One of these is *Dynamene bidentata* and it should be noted that its general breeding behaviour is also atypical, with a male usually sharing a crevice with a "harem" of females. The structure of the appendix masculina or the praeoperculum and other secondary sexual features are often diagnostic in otherwise very closely related species, but it should be emphasized that the length of the appendix masculina may also vary within a species depending upon male size and age.

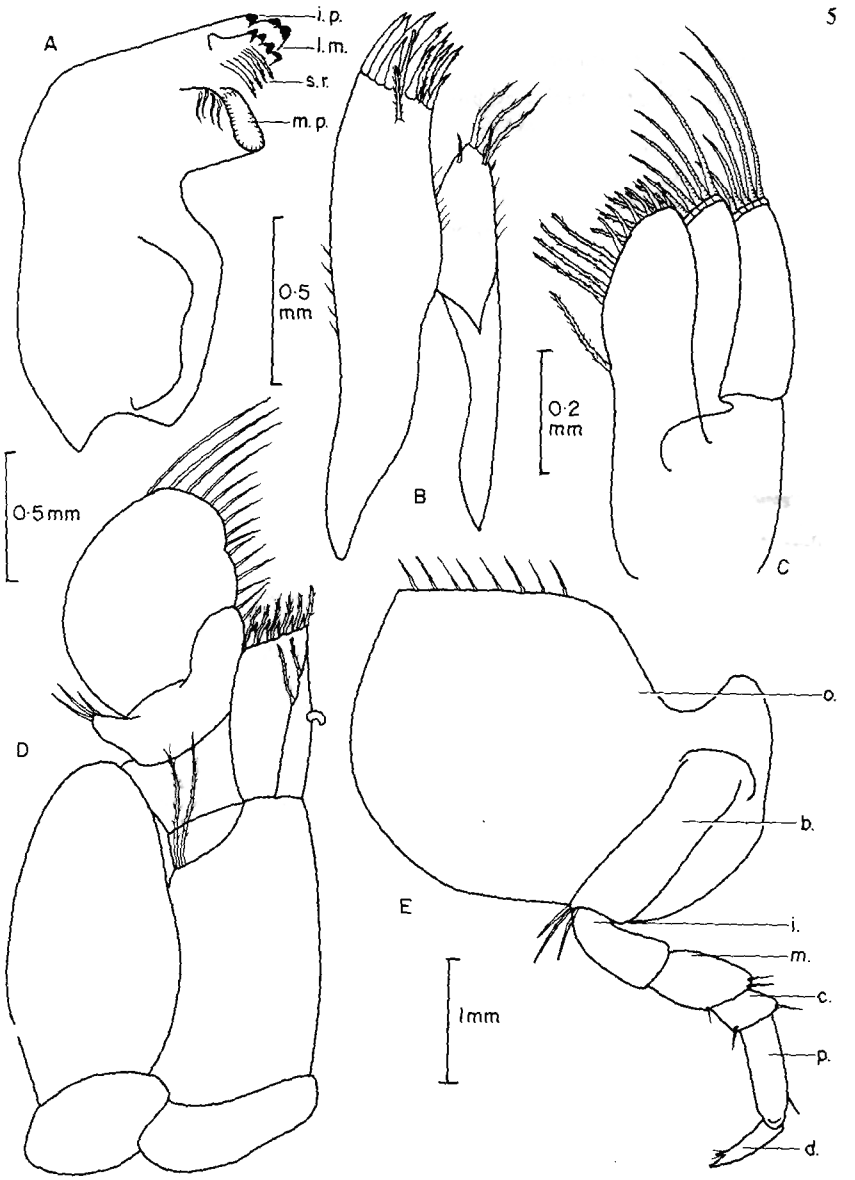


Fig. 2. Mouthparts and peraeopod of *Idotea*: **A**, mandible; **B**, maxillule; **C**, maxilla; **D**, maxillipede; **E**, female peraeopod.
(*i.p.* incisor process, *l.m.* lacinia mobilis, *s.r.* spine row, *m.p.* molar process, *o.* oöstegite, *b.* basis, *i.* ischium, *m.* merus, *c.* carpus, *p.* propus, *d.* dactyl.)

Marsupial Development

Typically, the eggs are released into and incubated in a ventral brood chamber formed by the oöstegites attached to the inner bases of up to 5 of the anterior peraeopods. Ventilation of the brood chamber is achieved by the maxillipede, the inner border of which bears a special ventilatory lappet in adult females. Most species studied so far have four marsupial stages (*Dynamene* has five) beginning with the more or less spherical egg which is surrounded by an outer egg membrane and inner embryonic membrane. Stage 2 is an elongate embryo surrounded by the embryonic membrane and Stage 3 is that at which the appendages are released but are still without setae. The cuticle of Stage 3 is shed to reveal Stage 4 which is eventually released as the first juvenile stage.

Not all littoral isopods incubate the eggs in the brood chamber. Some such as *Sphaeroma* and *Campecopea* carry them within invaginations of the body which open from the brood chamber, evidently correlated with their habit of rolling into a tight ball. Others such as the markedly modified Gnathiidae and Cryptoniscidae also incubate the embryos internally. Though there are no British representatives it is interesting to note also that members of the genus *Excirolana* show ovoviviparity, the embryos developing in paired "uteri" which open into the oviducts near their external openings.

In most, but not all, isopods, the brood is relatively uniform in its rate of development, brood numbers often decreasing owing to mortality during the incubation period of 1–2 months, depending upon the species. Brood number is usually linearly related to female size in any one locality, and for any one size in *Eurydice*, at least, brood numbers fall towards the northern limits of its range (Jones, 1970).

Post-Marsupial Development

The pattern of growth and development has been worked out in detail for several British species. In some such as *Dynamene* it is possible to characterize each growth stage (*instar*) on the basis of size, antennal flagellum articles, antennular aesthetascs and other characters (Holdich, 1968b). Other species such as *Idotea emarginata* and *Eurydice* are much less easy to characterize in this way (Naylor, 1955d; Jones & Naylor, 1967), but even in those species, and probably others too, the early instars are individually recognizable, particularly since instar 1 (marsupial Stage 4) has only 6 pairs of peraeopods and acquires the 7th pair during the next moult (*ecdysis*). Other major points of interest to look out for in development relate to the structural changes which occur in those species which are sexually dimorphic. Particularly notable are the Gnathiidae (Monod, 1926), some Sphaeromatidae (Hansen, 1905a), and the Epicaridea (Bonnier, 1900). In the Gnathiidae the female peraeon inflates to accommodate the developing eggs while the male acquires a considerably enlarged head with highly characteristic mandibles (Fig. 5). In those Sphaeromatidae which are sexually dimorphic, obvious sexual differences develop in the structure of the pleotelson and uropods (Fig. 11), while at the same time female mouthparts become less chitinized and have few spines and setae, all associated with their lack of feeding (see p. 8). In epicardians (see

p. 68), development proceeds through three distinct stages before the adult stage is reached. Adults may be bisexual or protandrous hermaphrodites, but in all families of the Epicaridea the female is large and often asymmetrical, with the small unmodified male closely associated with it, usually among the pleopods.

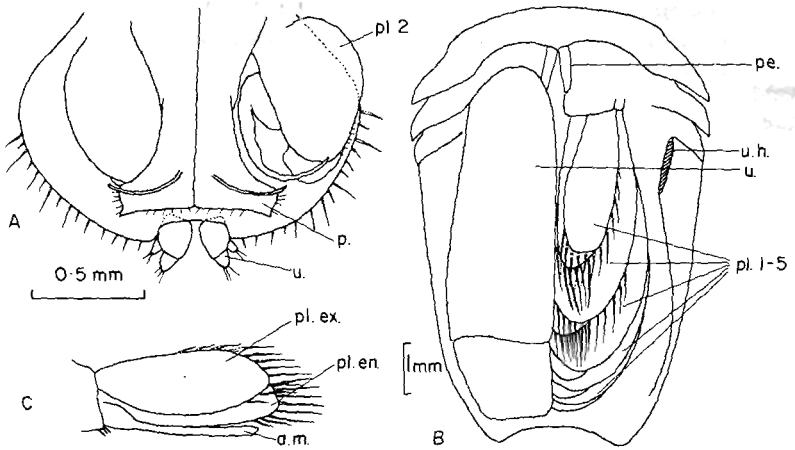


Fig. 3. **A**, ventral view of male pleotelson of an asellotan *Jaera ischiosetosa*; **B**, ventral view of male pleotelson of a valviferan *Idotea emarginata*; **C**, male pleopod 2 of *Idotea*. (*a.m.* appendix masculina, *p.* praeoperculum, *pe.* penis, *pl.* pleopod, *pl. en.* pleopodal endopod, *pl.ex.* pleopodal exopod, *u.* uropod, *u.h.* uropodal hinge.)

Feeding

Isopods are advanced peracarid crustaceans which have lost the free-swimming habit and filter-feeding mechanisms which are typical of primitive peracaridans such as the mysids. With the adoption of a bottom-living habitat they acquired a raptorial method of feeding in which they macerate large pieces of food. Accordingly they have frequently adopted the parasitic habit. The littoral species which have been studied in detail are *Ligia oceanica* by Nicholls (1931), *Idotea emarginata* by Naylor, (1955a), *Dynamene bidentata* by Holdich (1968c) and *Eurydice pulchra* by Jones (1968). The first three of these are essentially herbivorous, though *Idotea* will readily eat animal food if available, and *I. neglecta* has been reported as a serious pest of fish stored in keep nets (Kjennerud, 1950). *Dynamene* and some other sphaeromids evidently feed only as juveniles, with adult females being structurally incapable of doing so. In *Idotea* (Figs 2**B,D**) there are chisel-like spines on the maxillules and maxillipedes which abrade the surface of the food material, which is then bitten into by the incisor processes of the mandibles. Toothed spines on the maxillules and mandibles then push the food mass upwards between the molar processes of the mandibles where it is crushed and triturated. Debris is brushed forwards between the lobes of the paragnath by brush setae on the inner endites of the maxillules, maxillae and maxillipedes.

The continuous process of eating ensures a steady flow of food material upwards across the molar processes of the mandibles through the oesophagus and into the proventriculus. The latter is a dilated part of the foregut which is functionally modified for further crushing and trituration of the food. In addition it filters the fluid into digestive mid-gut caeca, separating it from the solid faecal matter which passes into the long, slender hind-gut and thence to the anus.

In *Eurydice* which is a highly predaceous carnivore, the mouthparts are adapted for tearing and bolting animal tissue. The most important differences between this species and herbivorous species are in the lack of a crushing molar process on the mandibles and in the presence of a distensible anterior hindgut where food may be stored for up to three weeks while undergoing gradual digestion. Anatomically *Eurydice* possesses all the essential preadaptations for a parasitic mode of life and has in error sometimes been so described. The genus is close to the Subfamily Aeginae to which many parasitic forms belong, and its feeding mechanism suggests how parasitism could have evolved within the Flabellifera.

Details of other feeding mechanisms remain to be worked out, most notably in forms such as *Jaera* which presumably scrape up sessile diatoms, gnathiid praniza larvae which feed suctorially on the blood of fish, and arcturids which have secondarily acquired a filter feeding mechanism involving the modified anterior peraeopods. Feeding in larval and adult epicarideans also remains largely unstudied. Detailed functional studies of isopod mouthparts are most useful in interpreting structural differences in these appendages, which are often used as important taxonomic characters.

Habitat Preferences

A feature of the ecological distribution of littoral isopods is the very close similarity which exists between related species and the frequency with which such closely related forms occur together in apparently similar habitats. This has presumably come about because they are usually benthic and incubate their eggs to a miniature adult stage before releasing them. There are therefore no specially adapted distributive larvae in isopods, and isolation in populations becomes very marked. This has led to speciation on a lavish scale between areas of minor physical differences. It is therefore a profitable exercise to consider the habitat preferences of littoral isopods.

Details of the known habitat, or microhabitat, of each species are given in the Systematic Part later. From the information given there it is evident that when collecting it is most important to record details of as many environmental factors as possible, e.g. tidal level, aspect, slope, whether collected under stones, in crevices, among attached algae or in algal-detritus, influence of freshwater, shore drainage, grade size of substrate, etc. In addition one should also clarify whether material comes from resident populations or from sublittoral species cast up on the shore. Ideally, routine collecting over a period of time is necessary to establish whether a population is resident or immigrant.

Economic Aspects

Isopods of various species such as *Cirolana* and *Conilera* are occasionally reported as pests of lobster pots in that they eat and destroy the fish used as bait. Some such as the Aeginae and Cymothoinae are minor ectoparasitics of fish, and *Idotea neglecta* has been reported as causing serious damage to live fish catches retained in keep nets (Kjennerud, 1950). The most important economic aspect of isopod ecology, however, relates to the wood-boring species of the genus *Limnoria* (Menzies, 1957), the small bore-holes of which give the surface of infected timber a spongy appearance. *Limnoria* generally penetrates for less than about 2 cm into the wood, but mechanical erosion after their initial surface burrowing often results in characteristic "pencil-point" erosion of harbour piling. It is not easy to separate the damage caused by *Limnoria* from that caused by the boring mollusc *Teredo*, since both types of organisms are generally found together, but the annual cost of marine borer damage in the United States in the 1950's was estimated at over 80 million dollars.

Limnoria burrows into wood using its "rasp and file" mandibles and there is evidence that it feeds upon the wood, digesting it by means of cellulolytic enzymes elaborated in the gut (Ray, 1959). In Britain all three species recorded so far can survive at tidal levels equivalent to around 60% exposure to air but, where the species occur together, some separation of their microhabitats is found to occur (Jones, 1963). In mixed populations, *L. tripunctata* dominates the upper level of attack, *L. quadripunctata* the middle zone and *L. lignorum* is found at the base of exposed piling or sublittorally. The first of these three species is most common where local heating occurs near industrial outfalls (Jones, 1963; Naylor, 1965).

Protection against *Limnoria* infestation is hampered by the fact that colonization of new timber is effected by swimming or crawling adults. In *Teredo* the infective stage is the larval stage which is about 100 times more sensitive to toxins than the adults. Accordingly, whereas *Teredo* can be prevented from attacking pine test blocks impregnated with creosote and creosote–coal tar solution, *Limnoria* was undeterred by such treatment (Colley & Burch, 1961). The addition of expensive copper compounds is necessary to deter *Limnoria*, particularly *L. tripunctata* which has the ability to colonize wood treated with creosote alone shortly after its immersion in seawater (Menzies, 1957).

Collection, Preservation and Examination

Since closely related species may occupy very similar microhabitats it is important when collecting littoral isopods to keep collections separate and well labelled. On rocky shores, turning stones will reveal species such as *Jaera* and *Sphaeroma* which can easily be picked off with forceps. Algae are best searched for *Idotea, Synisoma* and young *Dynamene* by rubbing the fronds through one's fingers. Alternatively, in the laboratory algae may be washed under running seawater which is allowed to flow through a sieve or simply allowed to stand in a vessel containing seawater until the animals swim or fall free. On the upper shore, barnacle scrapings should be searched for *Campecopea* and the barnacle parasite *Hemioniscus*, and crevices should be opened for *Sphaeroma*. Lower down the shore empty barnacles and crevices should be opened to search for adult *Dynamene*, *Cymodoce* and *Gnathia*. On the lower shore encrusting coralline algae, sponges, polyzoans and coelenterates should be scraped off and examined under a binocular microscope in the laboratory for *Janira* and *Janiropsis*, and smaller asellotans such as *Jaeropsis*, *Munna* and *Pleurogonium*. Strandings of sublittoral wrack cast up after a gale are well worth examining for sublittoral idoteids. In sheltered estuaries, salt marsh pools around HWS should be searched for *Sphaeroma rugicauda* which swim free from the vegetation, mud cliffs around HWN often harbour colonies of *Paragnathia formica*, and stones between tidemarks shelter large populations of *Jaera*. The last genus is also common on more open rocky coasts, particularly where freshwater streams flow across the shore.

On sandy shores disturbance of the sand between MTL and HWN, even with one's fingers, will often reveal the presence of *Eurydice* if it occurs. More quantitative observations should be made by sieving sand with the sieve half immersed in water. This is least energetically done at the water's edge as the tide is rising. A net towed through the surf on the upper part of the shore will often catch *Eurydice* when they swim up from the sand to feed, while a similar haul at low tide may take sublittoral idoteids in large numbers. The best catches with tow nets are usually made at night when *Eurydice* and other species can also be attracted to lights suspended at the surface. Interstitial isopods such as *Microjaera anisopoda* should be looked for in littoral sand by flooding the sample with a concentrated solution of magnesium sulphate or pumping seawater up through the sample to float off the interstitial organisms.

Once in tubes of seawater, the animals should be killed by the addition of a little formalin. This applies to species such as *Jaera* which tend to be cannibalistic, particularly of moulting individuals, if large numbers are kept in a small volume of water. Species such as *Sphaeroma* which tend to roll into a ball are best killed after first flattening them in an extended position beneath a glass plate or between two glass slides. Preservation should be in 70% alcohol or neutral 5% formalin. In acidic formalin specimens may lose cuticular carbonate and so eventually have surface sculpturing obscured.

Identification is best achieved by observing the material with the aid of a binocular microscope. Sometimes dissection of appendages is necessary and these can be mounted or teased off in glycerin on a microscope slide which can then be retained as a semi-permanent preparation. More permanent preparations can be made by transferring material straight from 70% alcohol to glycerin jelly or to a mountant such as polyvinyl lactophenol or Turtox CMC. Canada Balsam is not a very suitable mountant; its high refractive index often obscures fine detail of crustacean setae.

Classification

Order ISOPODA

Suborder Gnathiidea
  Family Gnathiidae
Suborder Flabellifera
  Family Anthuridae
  Family Limnoriidae
  Family Cirolanidae
  Family Sphaeromatidae
Suborder Valvifera
  Family Idoteidae
  Family Arcturidae
Suborder Asellota
  Family Janiridae
  Family Munnidae
  Family Pleurogonidae
  Family Jaeropsidae
  Family Desmosomatidae
  Family Eurycopidae
  Family Munnopsidae
Suborder Oniscoidea
Suborder Epicaridea
  Family Bopyridae
  Family Entoniscidae
  Family Dajidae
  Family Cryptonisidae

Systematic Part

There is some controversy about the subdivision of the Order Isopoda, turning mainly upon the status of the Family Gnathiidae. Many authors have usually allocated this Family to the Suborder Flabellifera (Marine Biological Association, 1957) or at most to a separate Suborder Gnathiidea equivalent to the Flabellifera, Valvifera, Asellota, Anthuridea and Oniscoidea (Grüner, 1965). On the other hand Menzies (1962) and Hurley (1961) have followed Monod (1922), who has separated the Suborder Gnathiidea, with 5 pairs of peraeopods, from all the remaining isopods which are included in an equivalent Suborder Quatuordecempedes or Tetracera, with 7 pairs of peraeopods. In that scheme the Flabellifera, Valvifera, Asellota, Anthuridea, Epicaridea and Oniscoidea are designated as Tribes. The classification adopted here basically follows that of Grüner (1965) thus conforming with the more prevalent European usage of several, rather than two, suborders.

Key to the British Suborders and Families

(Entirely sublittoral or terrestrial groups, for which brief diagnoses and references only are given, are indicated thus—*.)

1. Free living, or parasitic on fish, not parasitic on Crustacea . . . **2**
Entirely parasitic on Crustacea
(Suborder Epicaridea) **16**

2. Adults with 5 pairs of peraeopods
(Suborder Gnathiidea) . . . . . Family Gnathiidae (p. 16)
Adults with 7 pairs of peraeopods. **3**

3. Uropods lateral (Fig. 1) or ventral (Fig. 3B) **4**
Uropods terminal (Fig. 3A) **9**

4. Uropods ventral, hinged ventro-laterally to pleotelson to form opercular plates covering pleopods
(Suborder Valvifera) **5**
Uropods lateral, flattened and, with pleotelson forming a tail fan
(Suborder Flabellifera) **6**

5. Peraeopods all more or less alike . . . . . Family Idoteidae (p. 39)
Peraeopods 1–4 not ambulatory; resembling mouthparts and quite unlike 5–7 . . . . . Family Arcturidae (p. 49)

6. Body markedly attenuated; uropod bases extending dorsally above telson with caudal fan somewhat cup-shaped . . Family Anthuridae (p. 20)
Body robust; uropod bases not extending above telson **7**

7. Pleon with 5 distinct somites plus one fused with telson **8**
Pleon with less than 5 distinct somites, more than one fused with telson
Family Sphaeromatidae (p. 30)

8. Uropodal rami flattened, fan-like
Family Cirolanidae (including Cirolaninae, Aeginae* and Cymothoinae*)
(p. 24)
Uropodal rami tubular, outer ramus claw-like (Fig. 7A)
Family Limnoriidae (p. 22)

9. Aquatic, pleon consisting of less than 6 somites
(Suborder Asellota) **10**
Terrestrial, pleon usually with 6 distinct somites
(Suborder Oniscoidea*) . . . . . (p. 67)

10. Peraeopods 5–7 with some distal articles (carpus and propus) flattened and paddlelike, for swimming **11**
Peraeopods 5–7 normal, ambulatory **13**

11. Peraeopods 5–7 without dactyl; flat propus appearing as terminal article. Uropods terminal . . . . . Family Munnopsidae* (p. 66)
Peraeopods 5–7 with normal dactyl distal to flattened propus. Uropods ventral **12**

12. Peraeopods 5–7 flattened articles very well developed and with dense, plumose setae. Antennule basal article very large and flat
Family Eurycopidae* (p. 66)
Peraeopods 5–7 flattened articles not well developed and fringed with smooth setae. Antennule basal article not exaggeratedly large
Family Desmosomatidae* (p. 66)

13. Uropods lacking peduncle; peraeon with last 3 somites usually much smaller than anterior 4; eyes when present on lateral extensions of head **14**
Uropods with peduncle; peraeon somites all subequal, no exaggerated posterior narrowing; eyes not on lateral extensions of head . . **15**

14. Molar process of mandible normal, strong and truncated. Eyes present, on lateral extensions of head . . . . . Family Munnidae (p. 62)
Molar process of mandible weak and pointed (British genus, *Pleurogonium*, lacks eyes and head has no lateral extensions)
Family Pleurogonidae* (p. 64)

15. Antennal flagellum shorter than peduncle . Family Jaeropsidae (p. 64)
Antennal flagellum longer than peduncle . . . Family Janiridae (p. 50)

16. Parasitic in decapod crustaceans (crabs, prawns, etc.) **17**
Parasitic in other crustaceans (notably barnacles, isopods, ostracods, mysids, euphausiids) **18**

17. In gill chamber or attached to pleon of decapods. Female body with distinct somites, more or less asymmetrical and with 7 pairs of peraeopods. Oöstegites present. . . . . Family Bopyridae (p. 70)
In visceral cavity of decapods. Female body without distinct somites, symmetrical and lobed; peraeopods rudimentary or absent. Oöstegites present . . . . . Family Entoniscidae (p. 76)

18. On body or in brood chamber of mysids and euphausiids. Peraeopods well developed, numbering 5 pairs crowded near mouth. Oöstegites present
Family Dajidae* (p. 78)
Notably from barnacles, isopods and ostracods. Without peraeopods and, uniquely in the suborder, without oöstegites
Family Cryptoniscidae (p. 78)

Family GNATHIIDAE

Male, female and young (praniza) all of different form (Fig. 4); each with only five pairs of ambulatory peraeopods. Cephalon fused with two peraeon somites (not one as is typical in isopods), limbs of second fused somite modified as flattened pylopods (gnathopods (Fig. 5)) which cover the mouthparts ventrally. Last peraeon somite without limbs; best seen in males where it is narrow and equal in width to the pleon somites (Fig. 4A). Male with large mandibles which project in front of the cephalon and are forceps-like. Females and late pranizas with peraeon somites 3–5 fused and inflated, particularly in females, which incubate the eggs internally. Adults usually benthic, pranizas often ectoparasitic on fish and often taken in plankton nets.

Key to British Littoral Genera and Species of Gnathiidae

(For other British species see Naylor, 1957b and Monod, 1926.)

1. Male pylopod of 5 articles (Fig. 5A); adults usually in estuarine mudbanks
Paragnathia formica (Hesse) (p. 18)
Male pylopod of 2–3 articles (Fig. 5B); adults usually in marine crevice-like situations . . . . . (*Gnathia*) **2**

2. Male with ridge over each eye (Fig. 4F)
Gnathia oxyuraea (Lilljeborg) (p. 19)
Male without ridge over the eye **3**

3. Lateral mandibular spine diverging from mandible itself (Fig. 4D)
Gnathia dentata (Sars) (p. 19)
Lateral spine not diverging from mandible itself **4**

4. Front of cephalon with a shallow central concavity and a slight median forward projection (Fig. 4E) . . . *Gnathia maxillaris* (Montagu) (p. 19)
Front of cephalon with a deep central concavity and a small, acute median forward projection (Fig. 4G) . . . . . *Gnathia vorax* (Lucas) (p. 19)

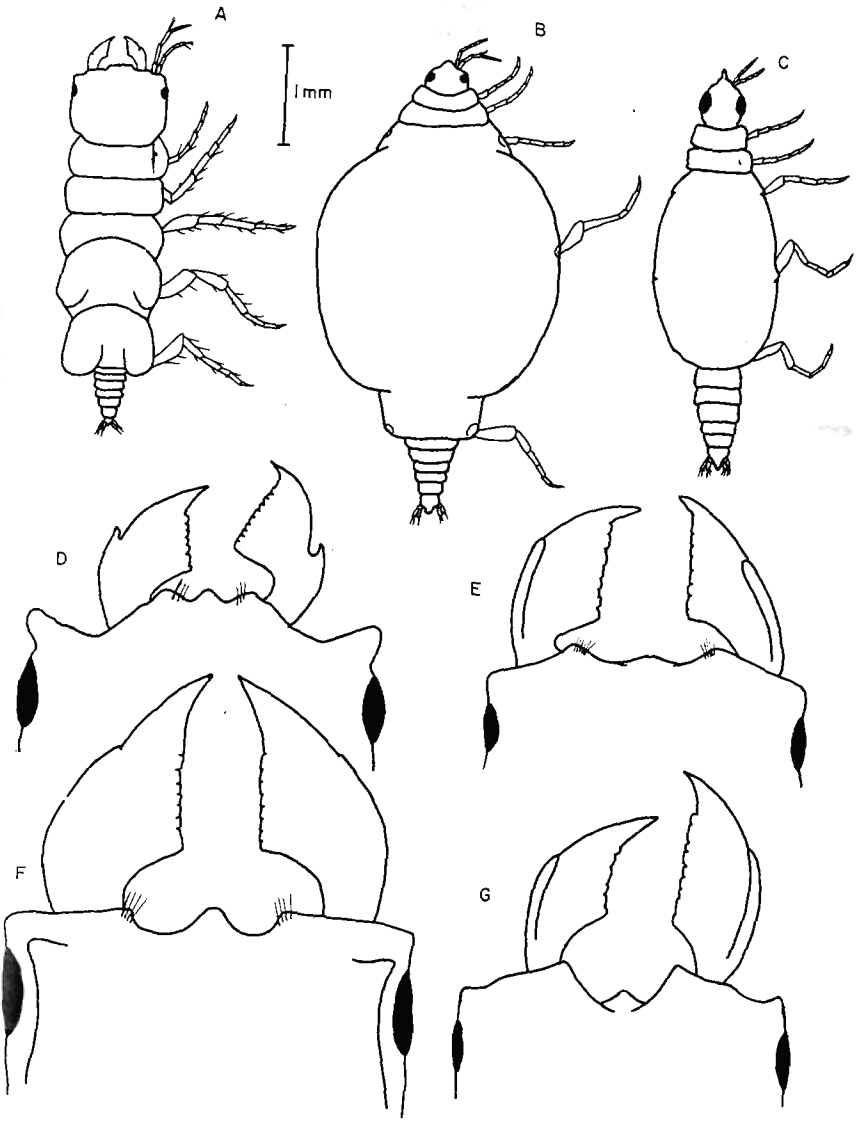


Fig. 4. *Paragnathia formica*. **A**, male; **B**, female; **C**, praniza.
Front of cephalon of: **D**, *Gnathia dentata*; **E**, *G. maxillaris*; **F**, *G. oxyuraea*; **G**, *G. vorax*.

Genus PARAGNATHIA Omer-Cooper

Adult male pylopod of 5 articles (Fig. 5A). Adults typically in galleries in mud cliffs on the banks of estuaries. There is only one British species.

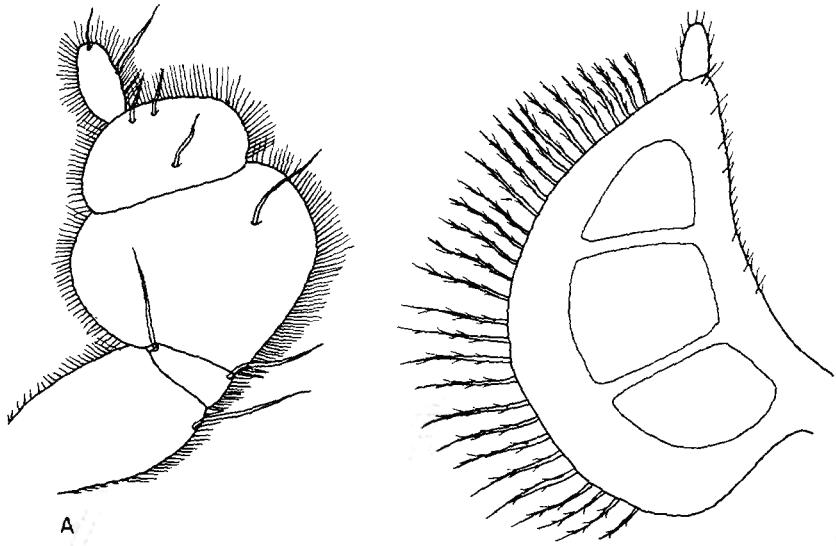


Fig. 5. Pylopod ("gnathopod") of **A**, *Paragnathia formica*; **B**, *Gnathia maxillaris*.

Paragnathia formica (Hesse) (Monod, 1926)

Family and generic characters readily permit identification of this species (Figs 4A,B,C, 5A). Males, females and pranizas from a population of the Towey Estuary, South Wales, all averaged around 4·0 mm body length (range 2·5–5 mm). Specimens were readily obtained by breaking apart pieces of mud cliff taken in a narrow zone around the level of MHWN tides. Adults occur in galleries 2–2·5 cm long, typically with a single male near the narrow mouth of the gallery (2–3 mm diameter) and up to 10 or 20 females at the innermost region where the gallery widens to about 5 mm diameter. Males were found in all months of the year; females first appeared in May, released their young pranizas from June to September, and died and disappeared from the samples in October. Newly released praniza larvae have been observed to attach to the fins of plaice (*Pleuronectes platessa*) in the laboratory and to feed on host blood. Late pranizas were found in the mud cliffs from spring to autumn, usually scattered singly throughout the mud and not associated with the adult colonies.

Most records of this species are from sheltered estuaries or inlets, usually around high water mark and in mud "cliffs" such as occur at the edges of salt-marsh. There are sporadic records of the species northwards from Morocco to Scotland with one record in the Mediterranean and none in the Baltic.

Genus GNATHIA Leach

Adult male gnathopod of 2 or 3 articles (Fig. 5**B**). Adults typically well hidden in crevices in open marine localities. *G. maxillaris* and *G. dentata* are the commonest intertidal forms but *G. vorax* and *G. oxyuraea* may occasionally also turn up.

Gnathia maxillaris (Montagu) Monod, 1926)

Not to be confused with *G. oxyuraea* which Sars (1899) erroneously illustrated as *G. maxillaris*. Male with the front of the cephalon having a shallow central concavity with only a slight rounded median forward projection; lateral corners square, cephalon wider than long (Fig. 4**E**). Lateral tooth of mandible closely applied to mandible itself. Male body length usually 4·5–5·0 mm or less.

Probably the commonest intertidal gnathiid in southern Britain, adults occurring in rock crevices and crevice-like situations such as dead barnacles and *Laminaria* holdfasts. It is recorded from the southern North Sea, southern England and Wales, Irish Sea and Ireland.

Gnathia dentata Sars (Monod, 1926)

Male with front of cephalon (Fig. 4**D**) centrally tridentate and without a concavity; lateral corners acutely pronounced. Cephalon broader than long. Lateral tooth of mandible diverging markedly from the mandible itself. Male body lengths 2·8–3·8 mm, females up to 4·3 mm. Recorded occasionally between tidemarks in *Laminaria* holdfasts at Plymouth and in the Isle of Man. Also recorded in Norway.

Gnathia oxyuraea (Lilljeborg) (Monod, 1926)

Male with front of cephalon having a median tooth bordered by a shallow concavity on each side; lateral corners square (Fig. 4**F**). Cephalon broader than long and with a pronounced ridge over each eye. Lateral tooth of mandible somewhat indistinct. Male body length 2·4–5·4 mm; females 3·9 mm.

Most British records are from dredged material among which it is probably the commonest gnathiid, but it should be looked out for intertidally. Recorded off most British coasts, also ranging northwards to the Barents Sea and southwards to the Mediterranean.

Gnathia vorax (Lucas) (Monod, 1926)

Male with front of cephalon (Fig. 4**G**) having a deep central concavity with a fairly acute median forward projection; lateral tooth of mandible closely applied to mandible itself. Males and females usually ranging from 5–7 mm body length, therefore larger than *G. maxillaris* with which it should not be confused.

Usually offshore, with sporadic records around the British Isles and reported from the Mediterranean northwards to Greenland.

Family ANTHURIDAE

Body long and narrow, subcylindrical. Peraeonal somites longer than wide. Pleon relatively short with uropodal exopods arching dorsally and medially over the telson. Two species of this family are commonly recorded on British shores, one in the genus *Anthura* and one in the genus *Cyathura*.

Key to British species of Anthuridae

1. Telson subquadrate, widest posteriorly (Fig. 6**A**). Maxillipede as in Fig. 6**C**.
   Marine . . . . . *Anthura gracilis* (Montagu)
   Telson narrowing to a rounded apex (Fig. 6**E**). Maxillipede as in Fig. 6**F**.
   Brackish . . . . . *Cyathura carinata* (Kröyer)

(There is an old record of a third species, *Paranthura costana* Bate and Westwood, from the Channel Islands. Unlike the previous two species this lacks the pair of statocysts on the telson and has piercing (not biting) mouthparts (see Barnard, 1925)).

Genus ANTHURA Leach

Anthura gracilis (Montagu) (Sexton, 1914)

Eyes large (Fig. 6**A**,**B**), particularly in males (Fig. 6**B**). Antennules of female small, those of male with flagellum elongate and densely clothed with filamentous setae (Fig. 6**B**). Maxillipede as in Fig. 6**C**. Pleon somites of females at most only slightly distinct, those of males more distinct; telson subquadrate, widest posteriorly (Fig. 4**A**). Females up to 11 mm body length, males smaller e.g. 4 mm.

In fully marine situations, mainly sublittoral, but occasionally between tide-marks in crevice-like situations such as among *Laminaria* holdfasts, and in empty tubes of polychaetes such as *Pomatoceros*, *Spirorbis* and *Sabellaria*. Recorded from Millport, the Isle of Man, South Wales, southwest England and the Mediterranean.

Genus CYATHURA Norman and Stebbing

Cyathura carinata (Kröyer) (Cleret, 1960)

Eyes small (Fig. 6**D**). Antennules small in both sexes. Maxillipede as in Fig. 6**F**. Pleon somites indistinct in both sexes; telson narrowing to a rounded apex (Fig. 6**E**). Body length up to about 14 mm. Whitish with red-brown mottling.

In estuaries or streams crossing the shore, usually in mud. In Britain recorded from England southwards and westwards to the South Wales coast. Also from Ireland, and in Europe from the southwestern Baltic to the Mediterranean and Adriatic.

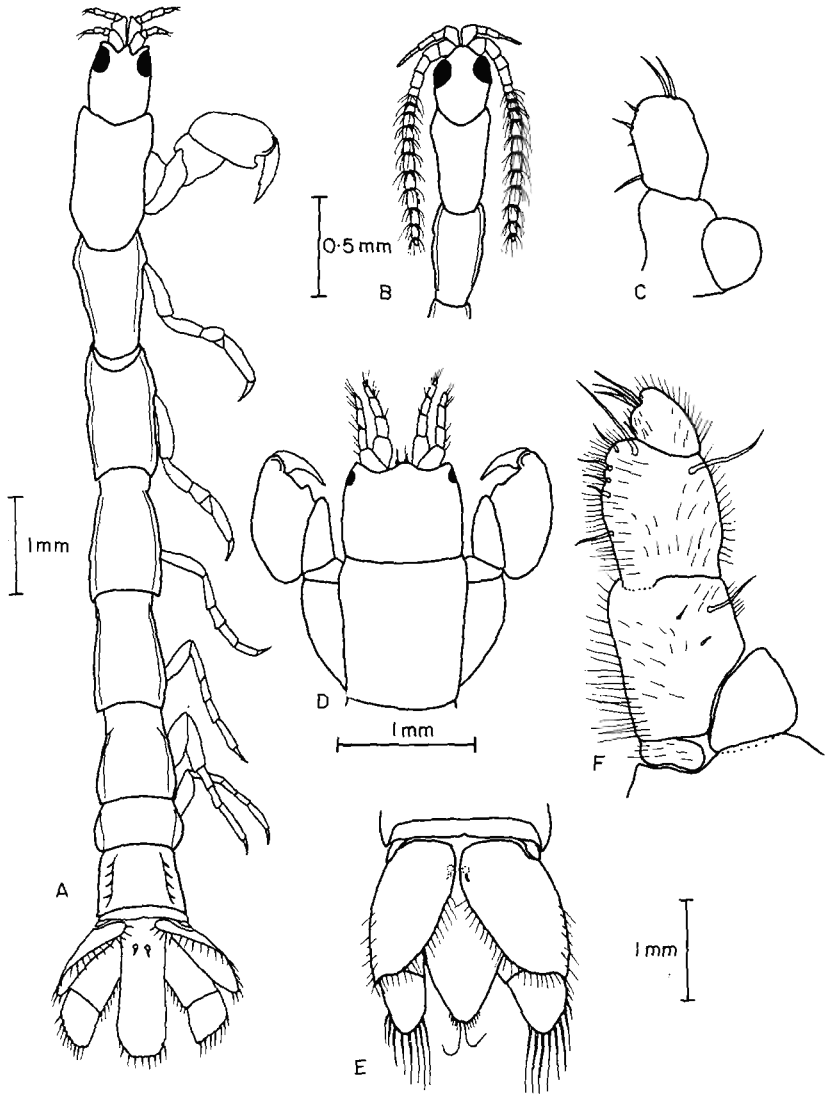


Fig. 6. *Anthura gracilis:* **A,** female; **B,** anterior region of male; **C,** maxillipede of female. *Cyathura carinata:* **D,** anterior region of female; **E,** pleotelson and uropods of female; **F,** maxillipede of female.

Family LIMNORIIDAE

Menzies (1957) reviews this family and splits it into two genera, *Limnoria* Leach and *Paralimnoria* g.n. The former genus is further divided into two subgenera: *Limnoria* (sens. str.) consisting of wood-boring species and *Phycolimnoria* consisting of algal-boring species. Three species of *Limnoria* (sens. str.) are recorded in Britain; *Phycolimnoria* is absent.

Genus LIMNORIA Leach

Antennular flagellum with 4 articles, antennal flagellum with 3, 4 or 5. Uropod exopod much shorter than endopod and with an apical claw; endopod elongate, apex blunt, lacking claw. Pleopod 5 lacks marginal setae.

Subgenus *Limnoria* Menzies

Mandible has incisor process with a "rasp" and "file" arrangement of scales and ridges; molar process absent. Wood-boring.

Key to the British Species of Limnoria

(With *Limnoria* it is as well to examine several specimens under various lighting conditions to become familiar with the key characters. It may also be necessary to clean away detritus from the postero-dorsal part of the body in order to see the tubercles or carinae.)

1. Dorsal surface of posterior border of pleotelson tuberculate. Central area of pleotelson with 3 tubercles (Fig. 7**C**) . . . *L. tripunctata* Menzies
Dorsal surface of posterior border of pleotelson smooth not tuberculate. Central area of pleotelson with 4 tubercles or with an inverted Y-shaped carina **2**

2. Central area of pleotelson dorsal surface with an inverted Y-shaped carina. (Fig. 7**A**) . . . . . *L. lignorum* Rathke
Central area of pleotelson dorsal surface with 4 tubercles. (Fig. 7**B**)
L. quadripunctata Holthuis

Limnoria (*Limnoria*) *lignorum* (Rathke) (Sars, 1899; Menzies, 1957)

Antennal flagellum of 4 articles. Pleon somite 5 with a mid-dorsal, longitudinal carina. Pleotelson (Fig. 7**A**) with an anteriorly situated mid-dorsal longitudinal carina, which bifurcates posteriorly and lacks tubercles; lateral crests of pleotelson slightly tuberculate, dorsal surface of posterior margin not so, but with a fringe of small, dorsally directed spines. Lacinia of right mandible with apex trifid. Up to 3·5 mm body length.

A boreal wood-boring species found on all British coasts but least common in the southwest. When in company with the other two species, *L. lignorum* occurs at the base of exposed piling or sublittorally where the wood is kept wet and cool (Jones, 1963). Recorded on the east and west coasts of North America as far south as latitude 40°N (Menzies, 1957) and in Europe from Norway southwards to a latitude probably little beyond southern Britain (Jones, 1963).

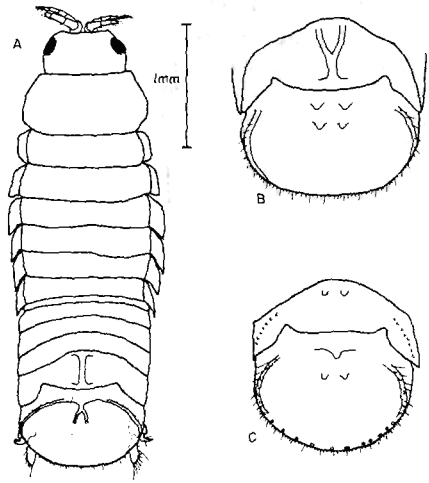


Fig. 7. **A,** *Limnoria lignorum*; **B,** pleotelson of *L. quadripunctata*; **C,** pleotelson of *L. tripunctata*.

Limnoria (*Limnoria*) *tripunctata* (Menzies) (Menzies, 1957)

Antennal flagellum of 5 articles. Pleon somite 5 with two anterior elevated nodes and perhaps a median posterior node. Pleotelson with an anterior median tubercle followed by a pair of tubercles, each followed by a slight longitudinal ridge; lateral crests and postero-dorsal margin tuberculate (Fig. 7C). Lacinia of right mandible with two apical spinous projections. Up to 4 mm body length.

This species has a fairly worldwide distribution in temperate–tropical waters. In Britain it occurs in South Wales and southern England, predominantly in areas which are artificially heated by power station cooling water, but it may be expected to spread from these areas particularly on the south coast. It occupies the upper level of *Limnoria* attack when two or more species occur together (Jones, 1963).

Limnoria (*Limnoria*) *quadripunctata* Holthuis (Menzies, 1957)

Antennal flagellum of 5 articles. Pleon somite 5 with a Y-shaped carina on mid-dorsal surface. Pleotelson with two pairs of tubercles (Fig. 7B), each of the posterior pair being followed by a slight longitudinal carina, especially in females; lateral crests of pleotelson and the postero-dorsal margin lack tubercles. Lacinia of the right mandible expanded at the apex which bears a fringe of serrations. Males up to 3·0 mm body length; females up to 3·4 mm.

A temperate species occurring on south and western coasts of Britain from Kent to the Isle of Man, occupying the middle zone of piles infested with *Limnoria* (Jones, 1963). Originally described from Holland (Holthuis, 1949), the range of this species in Europe to the south of Britain remains to be worked out. Elsewhere it is recorded from New Zealand, South Africa and the Californian coast of North America (Jones, 1963).

Family CIROLANIDAE

Body with distinct coxal plates on peraeon somites 2–7. Pleon with five distinct somites plus one (the uropodal somite) fused with the telson. Uropods lateral, not arching dorsally, and with the pleotelson forming a terminal fan.

Following Menzies (1962) this family is subdivided into several subfamilies which include the Cirolaninae, Aeginae and Cymothoinae. In Britain only the subfamily Cirolaninae has littoral representatives; representatives of the other two occur as ectoparasites on offshore fishes (Marine Biological Association, 1957). The Aeginae are flattened forms, with very large eyes which often almost meet in the mid-dorsal line, and with peraeopods 1–3 having very large prehensile dactyls. The Cymothoinae (including *Nerocila* and *Anilocra*) have large prehensile dactyls on all the peraeopods (Richardson, 1905).

Subfamily CIROLANINAE

In addition to the family characters these forms are usually more or less semi-cylindrical in shape, the eyes are lateral and of normal size, and dactyls of peraeopods 1–3 are not markedly larger than those of peraeopods 4–7.

Key to British Genera of the Subfamily Cirolaninae

1. Antennal peduncle of 4 distinct articles. Uropodal peduncle not produced backwards medial to endopod (Fig. 8**B**) . . *Eurydice* Leach (p. 26)
   Antennal peduncle of 5 distinct articles. Uropodal peduncle produced backwards medial to endopod (Fig. 9**C**) **2**

2. Pleopod 1 with endopod normal, not heavily chitinized; peduncle broader than long. Body not markedly elongate . . . *Cirolana* Leach (p. 28)
   Pleopod 1 with both rami heavily chitinized and forming an operculum; peduncle longer than broad. Body markedly elongate
   Conilera Leach (p. 28)

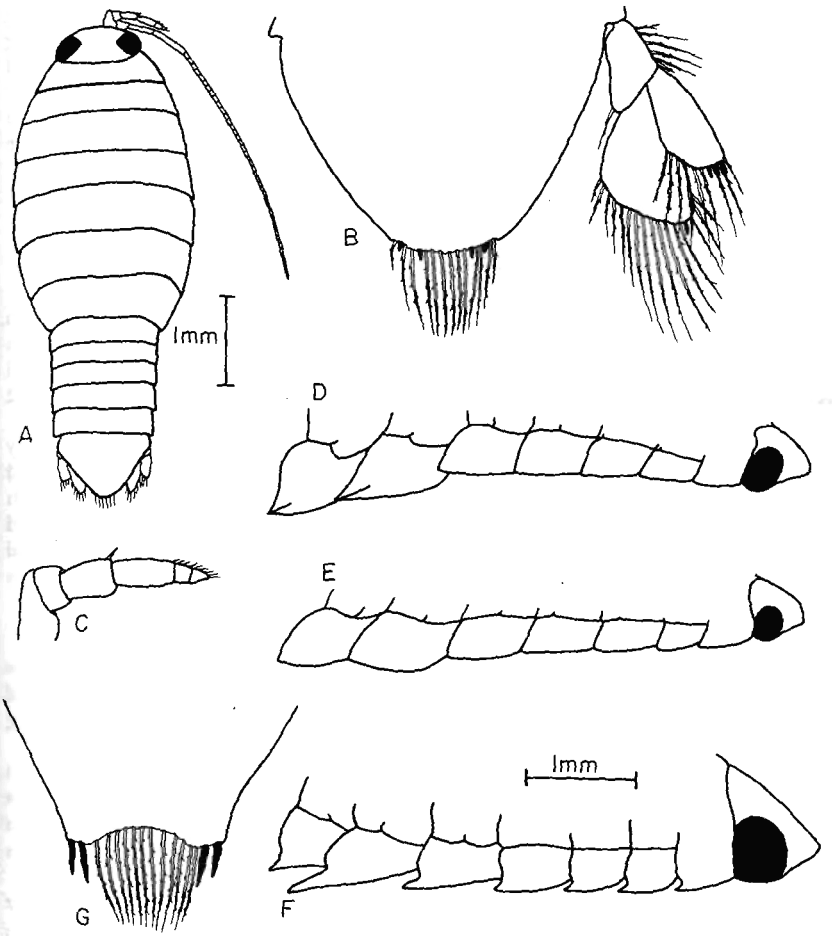


Fig. 8. *Eurydice pulchra*. **A,** dorsal view of whole animal; **B,** pleotelson and right uropod; **C,** right antennule; **D,** lateral view of cephalon and peraeon.
E. affinis, **E,** lateral view of cephalon and peraeon.
E. spinigera **F,** lateral view of cephalon and peraeon; **G,** pleotelson.

Genus EURYDICE Leach

Antennal peduncle of 4 distinct articles. Antennule with article 1 extending forwards, at right angles to article 2 (Fig. 8**A**,**C**). Maxillipedes without coupling hooks on inner border. Pleon somite 5 not markedly reduced, with lateral borders contributing to body outline (Fig. 8**A**). Pleopod 1 with both rami thinly chitinized and fringed with setae. Uropod peduncle not markedly produced backwards alongside inner border of endopod; articulation between peduncle and endopod short (Fig. 8**B**).

Key to British littoral Eurydice

(For offshore species see also Naylor, 1957b, and Jones & Naylor, 1967).

1. Pleotelson posterior border narrow and concave, with 2 large spines at each corner (Fig. 8**G**) . . . . . *E. spinigera* Hansen
Pleotelson posterior border broad and slightly convex, with a pair of small spines towards each corner among the plumose setae **2**

2. Peraeon somite 6 with posterior angle of coxal plate produced sharply backwards (Fig. 8**D**). Black chromatophores extending to lateral and ventral surfaces of body . . . . . *E. pulchra* Leach
Peraeon somite 6 with posterior angle of coxal plate acute but not produced sharply backwards (Fig. 8**E**). Black chromatophores restricted to dorsal body surface . . . . . *E. affinis* Hansen

Eurydice pulchra Leach (Sars, 1899; Hansen, 1905b)

Antennules similar in both sexes, reaching anterior lateral angle of peraeon (Fig. 8**A**); peduncle with article 3 a little longer than article 2 (Fig. 8**C**). Coxal plates of peraeon somite 6 with posterior angles produced into fairly long processes, and those of somite 7 with rather small processes (Fig. 8**D**).

Pleotelson with posterior border fairly broadly rounded, with two small spines towards each corner and with fairly long plumose setae (Fig. 8**B**). Males recognizable at about 4 mm body length, ranging to about 8 mm; females 4–6·5 mm. Colour darker than *E. affinis*, with numerous black chromatophores extending laterally and ventrally to the pleon.

Common below HWN in intertidal sand, from which it swims free on the rising tide. Generally distributed in Britain, falling off in abundance in the south-east (Jones & Naylor, 1967). It ranges from Norway and the outer Baltic to the Atlantic coast of Morocco, but evidently not into the Mediterranean (Soika 1955).

Eurydice affinis Hansen (Hansen, 1905b; Jones & Naylor, 1967)

Antennules scarcely reaching anterior lateral angle of peraeon; peduncle with article 3 scarcely longer than 2; flagellum thick in male, slender in female. Coxal plates of peraeon somites 6 and 7 with posterior angles sharp but not produced into processes (Fig. 8E). Pleotelson similar to *E. pulchra*: posterior border fairly broadly rounded, with two small spines at each corner among the fairly long plumose setae. A smaller species than *E. pulchra*, with males recognizable at just over 2 mm body length, ranging to about 5 mm; females 2–6 mm. Colour pale, with black chromatophores restricted to dorsal body surface; abdomen yellowish.

In Britain so far known mainly in the Bristol Channel area, on the coasts of South Wales and north coasts of Devon and Cornwall, among *E. pulchra* in intertidal sand (Jones and Naylor, 1967), but recently found in North Wales (D. A. Jones, pers. comm.). Also recorded on the Dutch coast (Wolff, 1966), but predominantly in the Mediterranean and on the Atlantic coasts of France (Soika, 1955).

Eurydice spinigera Hansen (Hansen, 1905b)

Antennules scarcely reach anterior lateral angle of peraeon; peduncle with article 3 slightly shorter than 2; flagellum robust in both sexes. Peraeon somites 2–6 with posterior corners of coxal plates produced into fairly long processes, those on somite 6 longer than in any other species (Fig. 8F). Pleotelson sharply narrowing posteriorly; posterior border emarginate with two conspicuous spines at each lateral corner on each side of the row of plumose setae (Fig. 8G). Body length up to 9 mm.

Of several *Eurydice* spp. occurring offshore in British waters this is the most likely to turn up occasionally in surf plankton or in intertidal sand among the common shore residents *E. pulchra* and *E. affinis*. It occurs on south and west coasts in Britain (Jones & Naylor, 1967) and in Europe it ranges from the southern North Sea (Holthuis, 1950) down the Atlantic coast of France into the Mediterranean (Soika, 1955).

Genus CIROLANA Leach

Antennal peduncle of 5 distinct articles (Fig. 9A). Antennule with article 1 orientated normally, not at right-angles to article 2 (Fig. 9A). Maxillipedes with coupling hooks on inner border. Pleon somite 5 small, barely reaching, and not contributing to, the lateral margin of the pleon (Fig. 9B). Pleopod 1 with endopod thinly chitinized and exopod thickly so; peduncle much broader than long. Uropod peduncle markedly produced backwards alongside inner border of endopod; articulation between endopod and peduncle long (Fig. 9C).

Of the several European species (Hansen, 1905b) none are strictly littoral in habitat. Perhaps the most likely strandings of these predacious swimming forms are of *Cirolana cranchii* which has been occasionally recorded between tide-marks.

Cirolana cranchii Leach (Hansen, 1905b)

This species can be distinguished from others in the genus on two characters. First, it has few, if any, plumose swimming setae on the last three peraeopods. Second, the frontal lamina, between the bases of the antennae and antennules, is small, pentagonal, less than twice as long as broad (Fig. 9A), and not visible from above.

The species is recorded intertidally at Plymouth (Marine Biological Association, 1957) and near Galway (personal record). Its known range is from the Mediterranean northwards to the Channel Islands and then along southern and western British coasts as far north as the Firth of Clyde.

Genus CONILERA Leach

There is one British representative, *C. cylindracea*, identifiable particularly by its very long cylindrical shape (Fig. 9D) (see Hansen, 1905b). It is a sublittoral resident in shell gravel, feeding carnivorously like *Cirolana* and *Eurydice*, and often taken with *Cirolana cranchii* on fish bait in lobster pots.

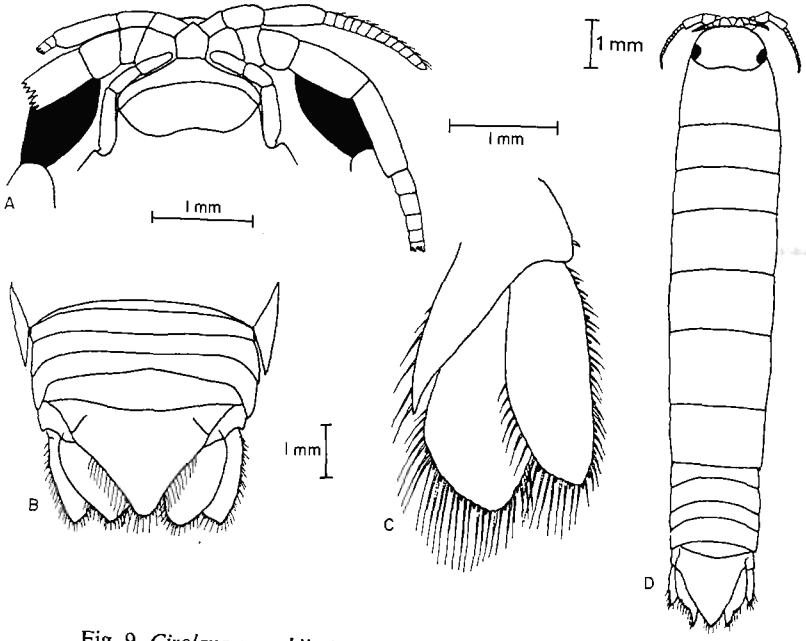


Fig. 9. *Cirolana cranchii*: **A,** ventral view of front of cephalon; **B,** pleon, pleotelson and uropods; **C,** uropods. **D,** *Conilera cylindracea*.

Family SPHAEROMATIDAE

Body oval in outline, readily rolling into a ball. Five anterior pleon somites all fused, usually with three sutures, the last two of which or all three are incomplete; sixth pleon somite fused with telson as a pleotelson which articulates freely with pleon. Coxal plates of peraeon somites 2–7 fused with somite, but suture lines may be evident. Uropods lateral; endopod rigidly fused with peduncle; exopod moveable. Sexual dimorphism apparent in some species, males of some of these bearing one or two backwardly directed projections on the posterior border of peraeon somite 6. Three groups of Sphaeromatidae were established by Hansen (1905a); Platybranchiata, Hemibranchiata and Eubranchiata. The first has all pleopods thin and without transverse fleshy folds, the second has pleopods 4 and 5 with normal exopods but with endopods thick, fleshy and transversely folded and the third has both rami of pleopods 4 and 5 with thick transverse folds. British genera of Sphaeromatidae, all of which are intertidal, are allocated to each of these groups as follows:

1. Platybranchiata: *Campecopea*
2. Hemibranchiata: *Sphaeroma*, *Cymodoce*
3. Eubranchiata: *Dynamene*

Key to British Genera and Species of Sphaeromatidae

(Based upon adult characters other than pleopods 4 and 5 which should be dissected out and mounted if in doubt as to the genus: see p. 30.)

1. Uropods with 1 ramus 2
   Uropods with 2 rami 3

2. Peraeon somite 6 without posterior processes *Campecopea hirsuta* ♀ (p. 36)
   Peraeon somite 6 with posterior border bearing a single large backwardly directed median process . . . . . *Campecopea hirsuta* ♂ (p. 36)

3. Peraeon somite 6 with posterior border bearing two backwardly directed processes . . . . . *Dynamene bidentata* ♂ (p. 35)
   Peraeon somite 6 without spines 4

4. Pleotelson with posterior border notched, appearing tridentate (Fig. 11**E**,**F**) or with a semi-circular foramen (Fig. 11**B**) in the midline . . . 5
   Pleotelson with posterior border not notched, smoothly rounded or slightly acute . . . . . (*Sphaeroma*) 7

5. Pleotelson posterior border with a semi-circular foramen in midline at the posterior end of a channel in the mid-ventral line (Fig. 11**B**)
   Dynamene bidentata ♀ (p. 35)
   Pleotelson posterior border slightly or markedly tridentate 6

6. Pleotelson posterior border with a marked tridentate process at the posterior end of a channel in the mid-ventral line (Fig. 11**E**)
   Cymodoce truncata ♂ (p. 38)
   Pleotelson posterior border slightly tridentate (looked at from above median tooth partly obscures lateral teeth) at the posterior end of a channel in the mid-ventral line (Fig. 11**F**) . . . . . *Cymodoce truncata* ♀ (p. 38)

7. Exopod of adult uropod serrated (Fig. 10**A**,**I**) 8
   Exopod of adult uropod at most slightly crenulate (Fig. 10**D**,**G**) . . 9

8. Peraeopods 1–3 (Fig. 10**B**) and maxillipede palp with plumose setae. Maxillipede palp without lobes on articles 2–4 (Fig. 10**C**)
   Sphaeroma serratum (Fabricius) (p. 32)
   Peraeopods 1–3 (Fig. 10**J**) and maxillipede palp with smooth setae. Maxillipede palp with prominent lobes on articles 2–4 (Fig. 10**F**)
   Sphaeroma monodi Bocquet, Levi & Hoestlandt (p. 34)

9. Pleotelson dorsal surface with two rows of elongate tubercles (Fig. 10**G**). Peraeopod 1 with propus lacking distal setae (Fig. 10**H**)
   Sphaeroma hookeri Leach (p. 32)
   Pleotelson dorsal surface with small tubercles (Fig. 10**D**). Peraeopod 1 with propus having 2 distal setae (Fig. 10**E**)
   Sphaeroma rugicauda Leach (p. 34)

Genus SPHAEROMA (Bosc)

No sexual dimorphism. Pleotelson rounded or only slightly acute at the apex, without a mid-ventral respiratory channel and posterior border not notched. Peraeopods (Fig. 10) 1–3 with long setae on the merus and ischium. Pleopods 4 and 5 with exopod lamellar and endopod thick and fleshy, with transverse corrugations. Uropods with expod and endopod subequal in length, endopod rounded at the apex. Females similar to males, showing no reduction of the mouthparts. Associated with the habit of rolling into a ball, eggs and young are incubated in internal pouches which are invaginations of the brood chamber.

Sphaeroma serratum (Fabricius) (Lejuez, 1966)

Antennule with 9–15 aesthetascs. Maxillipede palp without lobes but with plumose setae on articles 2–4 (Fig. 10**C**). Peraeopod 1 (Fig. 10**B**) ischium with up to about 60 plumose setae in two rows; propus with a distal row of 15–20. Uropods (Fig. 10**A**) with 4–7 well defined serrations on outer edge of exopod. Pleotelson with smooth dorsal surface and not extending beyond uropods. Sexes separable between 5–7 mm body length, females ranging to 10 mm and males to 11·5 mm.

In rock crevices or under stones at about MTL, usually on marine shores or at the mouth of estuaries, but occasionally near freshwater seepages on such shores. In the British Isles it occurs on south and west coasts of England and Wales, as far north as Anglesey, and on south and west coasts in Ireland. Its northern limit corresponds approximately with the 9°C isotherm for April, and it ranges southwards to Morocco and the Azores, including the Mediterranean and Black Sea (Harvey, 1969).

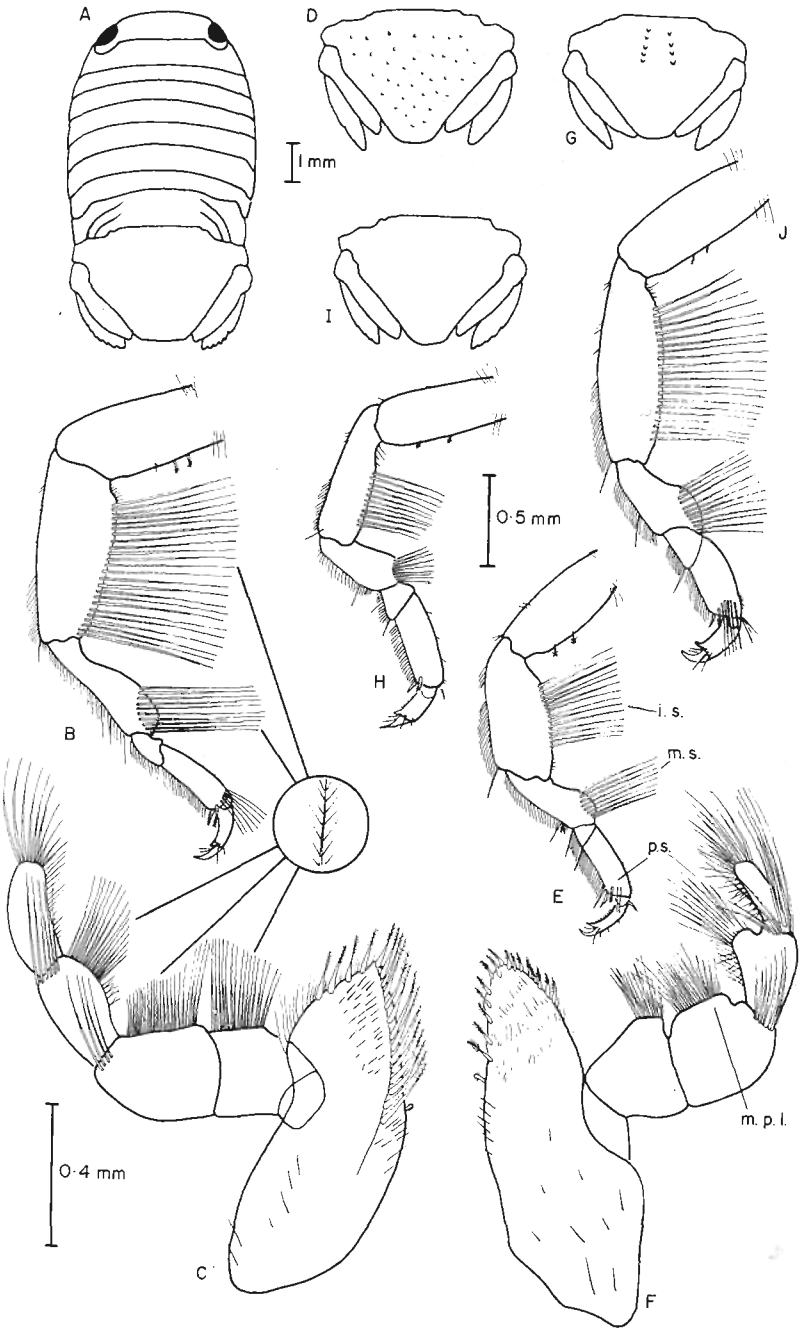
Sphaeroma hookeri Leach (Lejuez, 1966)

Antennule with 2–10 aesthetascs. Maxillipede palp with prominent lobes fringed with smooth setae on articles 2–4. Peraeopod 1 (Fig. 10**H**) with up to about 20 smooth setae on ischium and on merus; setae absent from distal region of propus. Uropods (Fig. 10**G**) with outer border of exopod almost smooth. Pleotelson with two longitudinal rows of elongate tubercles, one on each side of the mid-line; posterior border not extending beyond uropods.

Sexes recognizable at about 3·5 mm body length, males reaching 10·5 mm and females 8·5 mm.

Found at the head of sheltered estuaries, nearer the limit of EHWS than *S. rugicauda*. In brackish ditches, and sometimes taken on banks of river channel. Patchily distributed in Britain and absent from the northeast. Ranges from the Mediterranean northwards to northern Scotland and then eastwards into the southern Baltic as far as southeast Sweden (Harvey, 1969).

Fig. 10 (facing page). *Sphaeroma serratum*: **A**, adult male; **B**, peraeopod 1; **C**, maxillipede.
S. rugicauda: **D**, pleotelson; **E**, peraeopod 1; **F**, maxillipede.
S. hookeri: **G**, pleotelson; **H**, peraeopod 1.
S. monodi: **I**, pleotelson; **J**, peraeopod 1. (Maxillipedes of *S. hookeri* and *S. monodi* are like those of *S. rugicauda*.)
(*i.s.* ischium row of setae, *m.p.l.* maxillipedal palp lobe, *m.s.* merus row of setae, *p.s.* propus distal setae).


A
D
G
1 mm
I
J
0·5 mm
H
B
i. s.
m. s.
p. s.
E
0·4 mm
m. p. l.
C
F

Sphaeroma monodi Bocquet, Hoestlandt and Levi (Lejuez, 1966)

Antennule with 9–15 aesthetascs. Maxillipede palp with prominent lobes fringed with smooth setae on articles 2–4. Peraeopod 1 (Fig. 10J) with up to 70 smooth setae on ischium, about 100 on merus, and 3–8 in a distal row on the propus. Uropods (Fig. 10I) usually with 4–7 slight serrations on outer margin of exopod. Pleotelson with smooth dorsal surface; posterior border extending beyond uropod in large males. Males recognizable from 4·0 mm body length, ranging to 12·0 mm; females range from 4·0–8·0 mm.

A brackish species which occurs under stones and sometimes in rock crevices between MTL and LWN, replacing *S. serratum* in the middle reaches of estuaries. Sometimes on marine shores where freshwater flows over the shore. In the British Isles recorded from south and southeast England, Wales and eastern Ireland. On the European coasts it ranges from Belgium to northern Spain (Harvey, 1969).

Sphaeroma rugicauda Leach (Lejuez, 1966)

Antennule with 2–8 aesthetascs. Maxillipedal palp with prominent lobes fringed with smooth setae on articles 2–4 (Fig. 10F). Peraeopod 1 (Fig. 10E) ischium with up to 30 smooth setae, merus with up to about 20, and propus distal row with 2 (occasionally 1). Uropod (Fig. 10D) with outer edge of exopod almost smooth. Pleotelson dorsal surface covered with very small tubercles; extending beyond uropods in adult males. Sexes recognizable at 3·–3·5 mm body length, males reaching 10·0 mm and females 7·5 mm.

Widespread in Britain in sheltered estuarine situations, usually in salt marsh pools, often burrowing but also in crevices or under stones and drift wood between HWS–MTL near the limits of tidal influence. Apart from a single record in Morocco the range of this species is from the Bay of Biscay northwards to northern Scotland and then eastwards into the southern Baltic as far as southeast Sweden (Harvey, 1969).

Genus DYNAMENE Leach

Markedly sexually dimorphic (Fig. 11A,B). Peraeon somites equal in females, male with somite 6 overlapping 7 and produced into two pairs of backwardly directed processes, one small lateral pair and a much larger pair close to the mid-dorsal line. Pleotelson domed, keeled or smooth in female, rugose in males with a central tubercle or pair of tubercles; respiratory channel sometimes closing ventrally. Mouthparts in ovigerous females showing marked loss of chitin and setae. Pleopods 1–3 laminate with apical setae, pleopod 2 of male without appendix masculina; pleopods 4 and 5 with exopod and endopod thick, fleshy and with transverse folds. Uropods biramous in both sexes; males more setose than females, endopod of males usually with a small, smooth apical projection. Young carried in brood chamber formed by 4 pairs of oöstegites on peraeopods 1–4; does not roll into a tight ball. One species, *D. bidentata*, is recorded on British shores but a total of six species are described from European waters in a review of this genus by Holdich (1969) who also invalidates the use of the generic name *Naesa* which is often applied to this genus.

Dynamene bidentata (Adams) (Holdich, 1968a)

This species can be distinguished from others in the genus particularly on the male pleotelsonic tubercle which is relatively sessile and bluntly bilobed (Fig. 11A). In addition the two large median processes on peraeon somite 6 are only moderately rugose and unlike other European species do not have a prominent apical projection (Fig. 11A). Length up to around 7 mm in males, 6 mm in females. Colour variable; males mostly brown, young females green, red or yellow, ovigerous females white or colourless, associated with the considerable loss of tissue which takes place at the last moult. Juveniles occur among intertidal algae upon which they feed. Adults occur in rock crevices or the empty tests of *Balanus perforatus* (when present), each male usually with a "harem" of several females. In southern and western Britain (including Ireland) from Monach Island (D. M. Holdich, pers. comm.) and Ardrossan to the Isle of Wight then southwards along Atlantic coasts of France, Spain and Portugal. Mainly below MTL (Naylor & Quénisset, 1964; Holdich, 1970).

Genus CAMPECOPEA

Some sexual dimorphism, but no reduction of mouthparts in females. Pleotelson rounded, without prominent tubercles; posterior border not notched, and without a posterior mid-ventral respiratory channel. Peraeon somite 6 of male (but not female) with a long median, backwardly directed process (Fig. 11C). Pleopods 1–5 all lamellar, not fleshy and transversely corrugated. Uropod of both sexes with a large exopod and lacking an endopod. Females with oöstegites on peraeon somites 1–4, brood incubated in internal pouches, associated with habit of rolling into a tight ball. There is one species *C. hirsuta*, in this genus; *C. cranchii* (Leach) is the female of the same form.

Campecopea hirsuta (Mont.) (Omer-Cooper and Rawson, 1934)

Generic description applicable (Fig. 11C,D). Length up to 3·5 mm in females and 4·0 mm in males. Recorded mainly among the barnacles *Balanus balanoides* and *Chthamulus stellatus*, the lichen *Lichina* and in rock crevices, particularly on shores exposed to wave action, occurring most commonly around MTL on shallow slopes and up to HWN on steep slopes. In Britain so far recorded on suitable shores in Wales, southwards from Anglesey, and also in Devon and Cornwall. Elsewhere recorded from the Atlantic coasts of France southwards to West Africa (see Harvey, 1968).

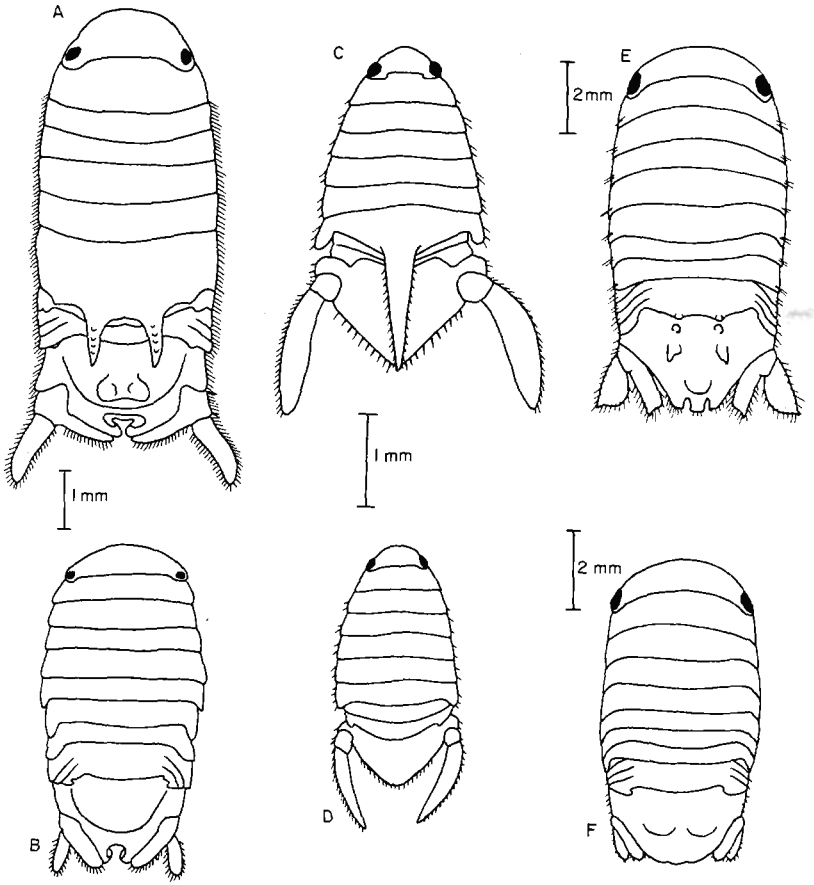


Fig. 11. *Dynamene bidentata*: **A,** adult male; **B,** adult female.
Campecopea hirsuta: **C,** adult male; **D,** adult female.
Cymodoce truncata: **E,** adult male; **F,** adult female.

Genus CYMODOCE

Markedly sexually dimorphic in the form of the pleon and pleotelson; female mouthparts reduced. Peraeon somites without posterior projections in either sex. Pleon posterior border raised into two prominent bosses, one each side of the mid-line. Pleotelson domed and smooth in females, with only two bosses or tubercles; rugose in males and with several prominent tubercles. Posterior border of male pleotelson markedly tridentate, median projection above and lateral projections at sides of the ventral respiratory channel. Posterior border of female pleotelson usually less obviously tridentate. Pleopods 4 and 5 with exopod lamellar, endopod thick, fleshy and with transverse corrugations. Uropod with two rami subequal in length. Female with brood developed in internal pouches as in *Sphaeroma* and all other hemibranchiate forms.

The taxonomy of this genus is in need of revision, as Omer-Cooper & Rawson (1934) emphasized when they provisionally referred British material to three species. These authors list two littoral forms *C. emarginata* and *C. truncata* but considered them both to be very variable and were unable to designate specific characters on the material available to them. The problem still remains through lack of material. For convenience here littoral *Cymodoce* are considered as one species *C. truncata* (see also Norman & Scott, 1906 and Marine Biological Association, 1957). Additionally it may be pointed out that in a collection of *C. truncata* from the Shetlands (British Museum Collection 55.95) one male closely resembles *C. granulatum* as figured by Omer-Cooper & Rawson (1934) notably in the possession of a prominent smooth, median tubercle towards the posterior end of the pleotelson. The status of *C. granulatum*, recorded sublittorally off Ireland, would therefore also seem to be worthy of further investigation.

Cymodoce truncata Leach (Omer-Cooper and Rawson, 1934)

Male pleon posterior border and pleotelson anterior border each with two tubercles; pleotelson central region with two pronounced tubercles or processes, posterior region with a low boss just anterior to trilobed posterior border (Fig. 11E). Very large specimens have a greater number of tubercles. The setation and granulation of the pleon and pleotelson of the males are variable, forms with dense granulation and setation having previously been allocated to *Cymodoce emarginata*.

Adult male body length 11 mm or more; females smaller.

Sometimes recorded among algae, but adults characteristically in crevices and old mollusc borings around LW. Patchily distributed from the Isle of Wight westwards and northwards to the Shetlands.

Family IDOTEIDAE

Body ovate, oblong or elongate. Peraeon somites and peraeopods all more or less alike. Pleon somites variously coalesced depending upon genus. Uropods usually uniramous.

Key to Genera and Species of Adult British Idoteidae

1. Pleon with no distinct somites; partial sutures (not visible from above) indicate almost complete fusion of pleon with telson. . (*Synisoma*) 2
   Pleon of 2 or 3 distinct somites; remainder fused or partially fused with telson 3

2. Peraeon lateral borders appearing serrated; pleotelson expanded laterally in the middle (Fig. 14**B**) . . . . . *Synisoma lancifer* (Leach) (p. 46)
   Peraeon lateral borders straight and parallel; pleotelson narrowing evenly to an acute point (Fig. 14**A**) . . *Synisoma acuminatum* (Leach) (p. 46)

3. Pleotelson with 3 complete somites and one partial suture. Animal usually occupying a "case" . . . . . *Zenobiana prismatica* (Risso) (p. 48)
   Pleotelson with 2 complete somites and one partial suture. Free living (*Idotea*) 4

4. Pleotelson apical border straight or concave 5
   Pleotelson apical border produced and more or less angulate in centre 7

5. Body markedly elongate, coxal plates very small not reaching posterior border on any peraeon somite (Fig. 12**C**) *Idotea linearis* (L.) (p. 43)
   Body not markedly elongate, coxal plates 3–7 reaching posterior border of peraeon somites 6

6. Pleotelson with apical border concave, sides somewhat rounded (Fig. 12**E**) Cephalon lacking complete suture behind the eyes (i.e. *not* as in Fig. 12**B**) *Idotea emarginata* (Fab.) (p. 42)
   Pleotelson apical border and sides straight. Cephalon with distinct sinuous suture behind the pronounced eyes (Fig. 12**B**) *Idotea metallica* Bosc. (p. 43)

7. Pleotelson apical border tridentate or nearly so (Fig. 12**D**) *Idotea baltica* (Pallas) (p. 40)
   Pleotelson apical border not tridentate, almost invariably rounded laterally 8

8. Pleotelson sides slightly concave, apical margin with a pronounced, acute median process (Fig. 13**A**) . . . *Idotea granulosa* Rathke (p. 42)
   Pleotelson sides straight or slightly convex, apical margin with at most an indistinct, blunt median process. 9

9. Antenna with flagellum much shorter than peduncle; flagellum densely covered with fine setae in males (Figs 13**C**,**F**) *Idotea pelagica* Leach (p. 44)

Antenna with flagellum longer than peduncle; flagellum not densely covered with fine setae in males **10**

10. Body slender; length 4–5 times width in all but ovigerous females which are wider (Fig. 13**B**). In brackish water . . *Idotea chelipes* (Pallas) (p. 40)
Body more robust; length little more than 3 times width (Fig. 12**A**). Sublittoral but often stranded among drift weed on the shore
Idotea neglecta Sars (p. 44)

Genus IDOTEA Fabricius

Body oval, oblong or elongate. Cephalon usually subquadrate, eyes dorsolateral, prominent or very prominent. Coxal plates on peraeon usually well defined on somites 2–7 (exception *I. linearis*). Maxillipedal palp of 4 articles. Pleon of 2 complete somites, and one partial suture in the pleotelson (Fig. 12**A**).

Idotea baltica (Pallas) (Sars, 1899; Naylor, 1955b)

Body oblong oval. Antennule extending to or just beyond article 3 of antennal peduncle; antennal flagellum longer than peduncle and about ¼ body length. Coxal plates large in adults, extending from anterior to posterior borders of peraeon somites 2 or 3 to 7. Pleotelson dorsally keeled, with more or less straight sides, tapering to a tridentate posterior border with median process long and acute (N.B. juveniles lack tridentate posterior border (Fig. 12**D**)).

Males first recognizable at about 10 mm body length, ranging to 30 mm; females 10–18 mm in length. Colour sometimes uniformly green or brown but often with white spots or longitudinal lines; female often darker than male.

Generally offshore, but in Britain not infrequently found among attached algae on the shore and often cast up in large numbers among drift weed. Fairly cosmopolitan, and widespread in Europe from northern Norway into the Gulfs of Bothnia and Finland, and south to the Black Sea.

Idotea chelipes (Pallas) (Sars, 1899, p. 83, as *viridis*, pl. 34(2) as *angusta*; Naylor, 1955b, as *viridis*)

Body slender (Fig. 13**B**). Antennule extending well beyond article 3 of antennal peduncle; unlike most species there is a single large aesthetasc, not a pair, at the distal end of the aesthetasc series on the antennule (Fig. 13**E**). Antennal flagellum longer than the peduncle, about ¼ body length. Coxal plates narrow, only those of peraeon somites 5, 6 and 7 reaching the posterior border. Pleotelson with sides subparallel, slightly keeled posteriorly in the mid-dorsal line; posterior border with a single, median tooth, hardly acute, and with obtuse lateral corners.

Males recognizable from about 5 mm body length, ranging to 15 mm; adult females from 6 to 10 mm. Colour mostly uniformly green or brown sometimes with white markings; females often darker than males.

A brackish water species which is patchily distributed in Britain among intertidal algae in sheltered estuaries or where streams flow over the shore, and also in sheltered brackish pools at or above high water mark. Recorded from Norway to the Mediterranean, including the Gulfs of Bothnia and Finland.

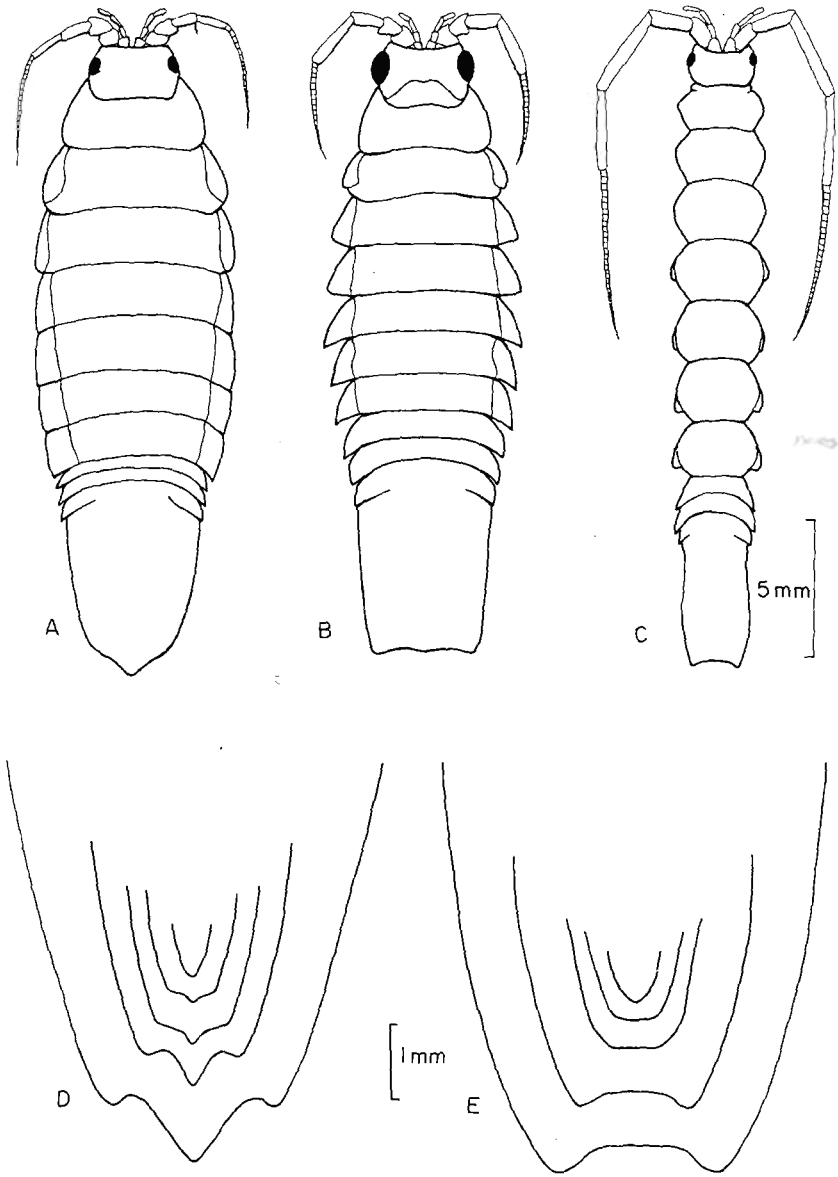


Fig. 12. Adult males of **A,** *Idotea neglecta*; **B,** *I. metallica*; **C,** *I. linearis*. Growth changes in pleotelson shape of **D,** *I. baltica*; **E,** *I. emarginata*.

Idotea emarginata (Fabricius) (Sars, 1899; Naylor, 1955b)

Body oblong oval. Antennule extending beyond article 3 of antennal peduncle. Antennal flagellum longer than peduncle and about $\frac{1}{6}$–$\frac{1}{5}$ the length of the body. Coxal plates broad, extending over the whole length of the somites 2 or 3 to 7. Pleotelson with sides slightly convex, posterior border emarginate, but see Fig. 12E for variation during growth.

Males first recognizable from 7–9 mm and ranging to about 30 mm; females from 9–18 mm. Colour of males often uniformly brown in colour, though sometimes with white markings; females generally darker in background colour, often with longitudinal lateral white bands, or alternating white and darker transverse bands.

Generally sublittoral on accumulations of detached algae, but occasionally between tidemarks on attached algae and in large numbers among cast up drift weed. On fully marine European coasts from Norway to Spain.

Idotea granulosa Rathke (Sars, 1899; Naylor, 1955b)

Body oval (Fig. 13A), narrowing rather sharply posteriorly. Antennule extending beyond article 2 but not article 3 of antennal peduncle; the most distal aesthetascs as a pair (Fig. 13D). Antennal flagellum not reaching length of peduncle (except possibly in largest males which have tufts of setae on the flagellum); usually less than $\frac{1}{3}$ body length: coxal plates fairly narrow reaching posterior border only in somites 4–7. Pleotelson narrowing sharply at first, with rather concave lateral sides; posterior border with long, acute, median spine and very obtusely rounded lateral shoulders; not keeled.

Males recognizable around 5 mm, ranging to about 20 mm body length; females 6–13 mm. Colour mostly uniformly brown, red or green, depending on the nature of the weed inhabited; occasionally with longitudinal white markings.

The common resident idoteid between tidemarks in Britain, large specimens predominating on *Ascophyllum* and *Fucus*, and small specimens preferring smaller algae such as *Cladophora* and *Polysiphonia*. Replaced on exposed shores by *I. pelagica* and on sheltered estuarine shores by *I. chelipes* (Naylor, 1955c). A northern species ranging from the White Sea to southern Britain and Normandy; also extending into the Gulfs of Bothnia and Finland.

Idotea linearis (L.) (Baté & Westwood, 1868; Naylor, 1955b)

Body very slender (Fig. 12C); length 4–7 times the width. Antennule extending just beyond article 2 of antennal peduncle; like *I. chelipes*, but unlike the others, with a single aesthetasc, not a pair, at the distal end of the aesthetasc series (see Fig. 13E). Antenna very long and slender; peduncle rather longer than the flagellum, which is about $\frac{1}{3}$ body length. Coxal plates very small, not extending to the posterior border of any peraeonal somite. Peraeopods long and slender, somewhat palmate distally; 2–7 of adult males with pads of fine setae on their inner borders. Pleotelson with sides slightly concave anteriorly; posterior border concave and with a small median spine in young specimens.

Males often recognizable from about 15 mm, ranging to over 40 mm in length; females rather smaller. Colour green or brown, with darker or lighter longitudinal stripes; adult female often darker than male, frequently with paler markings around the edges.

A sublittoral species occasionally cast up on the shore and often found swimming near the water's edge on sand shores at low tide. It is common in the Mediterranean, ranging south to Morocco and the Canaries and north as far as Denmark and Britain. Recorded in southwest Britain and Ireland; sparse when looked for intensively in the Isle of Man and probably rare on Scottish coasts.

Idotea metallica Bosc. (Collinge, 1917; Naylor, 1957a)

Body oblong (Fig. 12**B**). Cephalon with marked transverse sinuous furrow behind the eyes; eyes large and bulbous; antennules hardly extending beyond article 3 of antennal peduncle; antenna robust, flagellum shorter than peduncle and about $\frac{1}{6}$ the length of the body. Coxal plates triangular, extending over the whole length of the somite in peraeon somites 2 or 3 to 7; 5–7 sharply produced laterally. Pleotelson with sides and posterior border straight. Length in males recognizable from about 8 mm, ranging to about 30 mm; females from 9 to 18 mm. Colour is uniformly greyish or brown.

This species occasionally reaches British waters from the east coast of North America, among floating weed, timber and colonies of *Lepas* carried by the Gulf Stream and North Atlantic Drift (Naylor, 1957a).

Idotea neglecta Sars, 1899 (Naylor, 1955b)

Body oblong oval (Fig. 12A). Antennule more or less reaching the distal end of article 3 of antennal peduncle; antennal flagellum longer than peduncle, $\frac{1}{4}$–$\frac{1}{5}$ the body length. Coxal plates wide, extending the whole length of somite from peraeonal somite 2 or 3 to 7. Pleotelson with sides fairly straight and converging posteriorly; posterior border characterized by a median obtuse tooth, and obtusely rounded lateral shoulders; keeled.

Males recognizable from about 8 mm, ranging to nearly 30 mm; adult females range from 10 to 16 mm. Colour often uniformly brownish, sometimes with white longitudinal lateral markings, and occasionally with white marbling over the whole dorsal surface; adult females mostly darker than males.

Generally sublittoral on accumulations of detached algae or fish waste, but in Britain often found between tidemarks, usually in company with *I. baltica* and *I. emarginata* among cast up drift weed. On fully marine European coasts from Norway to France.

Idotea pelagica Leach (Sars, 1899; Naylor, 1955b)

Body short and stout (Fig. 13C). Antennule extending well beyond article 2, but hardly beyond article 3 of antennal peduncle; antenna very robust; flagellum shorter than peduncle, less than $\frac{1}{6}$ body length and with pads of fine setae in adult males (Fig. 13F). Coxal plates fairly broad, widening posteriorly and reaching posterior border of peraeonal somites 4–7. Peraeopods all very robust, the terminal claw being relatively larger than that of any other species; adult males with peraeopods 2–7 fringed with pads of fine setae on their inner surfaces. Pleotelson broadly rounded, apical border having a short, median, obtuse tooth; not keeled.

Males recognizable at about 4 mm, ranging to 11 mm; females 7–10 mm. Colour merges well with typical background of barnacles, mostly dark purple-brown, with white diamond-shaped patches or elongated stripes down the mid-dorsal line, and with white markings along the edges of the dorsal side; females often darker than males.

Resident on exposed shores among barnacles and stunted fucoid algae. Recorded from Norway to the French coast, and not ranging to the low salinity waters of the inner Baltic.

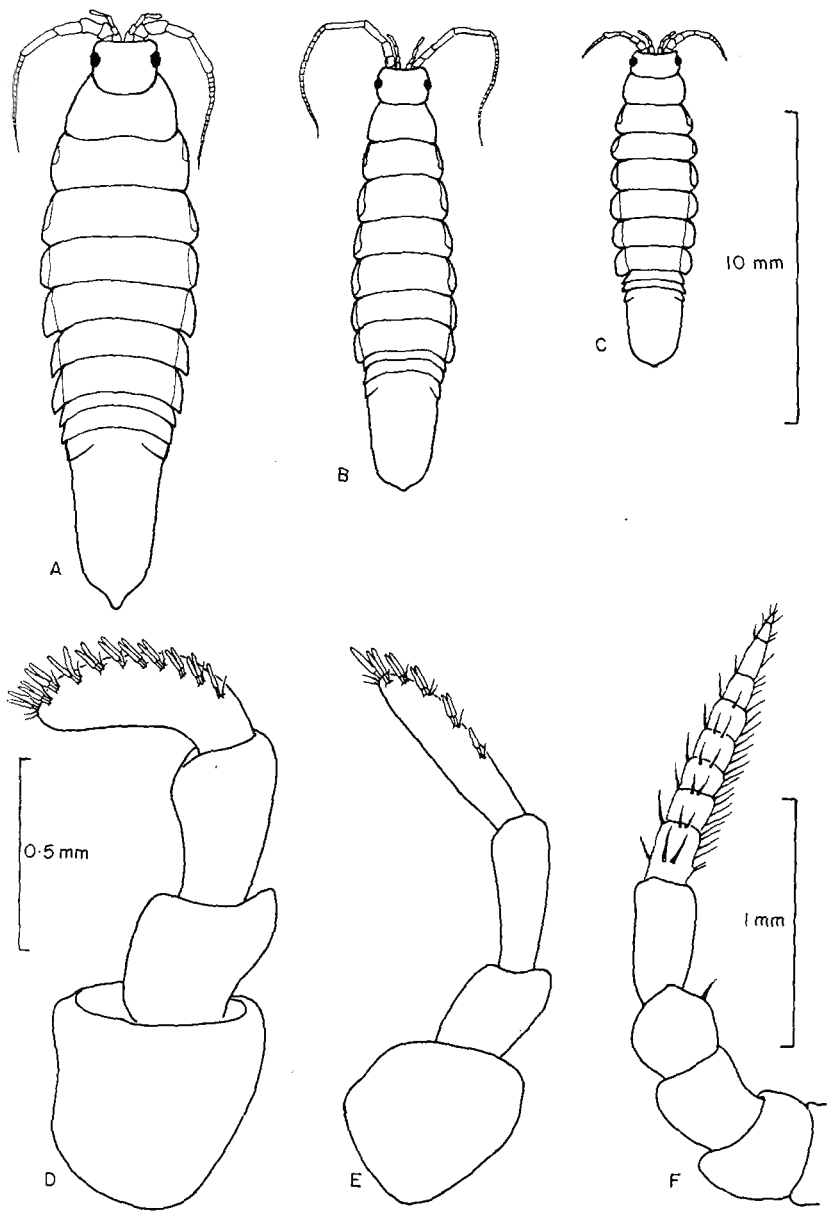


Fig. 13. Adult males of resident shore idoteids: **A,** *Idotea granulosa*; **B,** *I. chelipes*; **C,** *I. pelagica*: Antennules showing aesthetasc series in **D,** *I. granulosa* and **E,** *I. chelipes*; **F,** antenna of *I. pelagica*.

Genus SYNISOMA Leach

Body elongate. Cephalon with pronounced anterolateral lobes; eyes lateral, fairly small. Coxal plates small. Maxillipedal palp of 4 articles. Pleon with no distinct somites; entire post peraeon region as a pleotelson with at most only partial antero-lateral sutures (Fig. 14A,B).

Synisoma lancifer (Dollfus) (Bate & Westwood, 1868, as *Idotea appendiculata*; Collinge, 1917)

Peraeon with coxal plates triangular; lateral borders appearing more or less symmetrically serrated (Fig. 14B). Pleotelson (Fig. 14B) sides concave anteriorly, expanding about two-thirds of its length backwards, then narrowing sharply to an elongate median projection. Males up to 22·5 mm body length, female smaller. Recorded among algae and under stones particularly around LWM, on the coasts of Devon, Cornwall, Scilly Islands, Channel Islands, western France and the Mediterranean.

Synisoma acuminatum Leach (Bate & Westwood, 1868, as *Idotea acuminata*; Dollfus, 1894)

Body long, narrow and subcylindrical; coxal plates of peraeon very small, barely visible from above (Fig. 14A). Pleotelson sides narrowing fairly evenly from the peraeon articulation to an acute terminal projection (Fig. 14A). Up to 25 mm in length and rather less than 5 mm in breadth.

Typically recorded among the alga *Halidrys siliquosa* in pools on rocky shores around MTL; it mimics very closely the shape and brown colour of the air vesicles of the alga. Recorded in the Black Sea, Adriatic and Mediterranean, then ranging to the south and west coasts of Britain as far north as southwest Scotland. It also occurs in Ireland, personal collections having been made at Spiddal, near Galway.

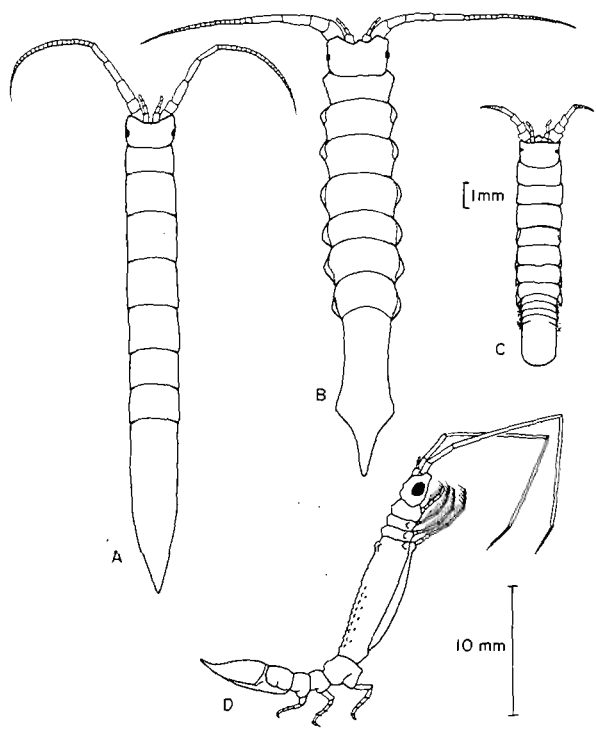


Fig. 14. Adult males of **A,** *Synisoma acuminatum*; **B,** *S. lancifer*; **C,** *Zenobiana prismatica*; **D,** Adult female *Astacilla longicornis*.

Genus ZENOBIANA Stebbing

Body long, slender and parallel sided (Fig. 14C). Cephalon subquadrate, with small lateral eyes. Antennae very short. Maxillipedal palp of 5 articles. Coxal plates small and narrow but distinct. Pleotelson of 3 distinct somites with evidence of a 4th in the partial suture of the pleotelson. Lateral borders of pleon fringed with setae (Fig. 14C).

Zenobiana prismatica (Risso) (Bate & Westwood, 1868, as *Idotea parallela*; Collinge, 1917)

There is only one British representative of this genus, so the generic characters permit identification of the species which ranges up to 13·5 mm in length. Typically found in a case, in hollowed out plant material such as *Zostera* stems, or in old worm tubes such as those of *Pomatoceros*. Recorded in the Firth of Clyde, south and west England, Jersey, west France, Mediterranean and the Adriatic.

Family ARCTURIDAE

Readily identified valviferan isopods with the body subcylindrical and elongate. Somite bearing peraeopod 1 often fused with cephalon; middle peraeon somite enlarged. Peraeopods 1–4 elongate, with long plumose setae, and directed toward the mouth; peraeopods 5–7 short, stout and adapted for clinging. Pleon somites variously fused. Uropods generally biramous.

There are several British species which cling to sublittoral algae, echinoderm spines, large sessile coelenterates, etc. They rarely turn up between tidemarks, but a species from each of the two British genera has been recorded on the shore.

Key to Genera of British Arcturidae

1. Middle peraeon somite (4) long and cylindrical . . . . . *Astacilla*
   Middle peraeon somite long, not cylindrical but with angled corners *Arcturella*

Genus ASTACILLA Cordiner

Body extremely slender and subcylindrical. Middle somite (4) of peraeon considerably elongate; much longer than anterior somites and cephalon together. Peraeopods 1–4 very densely setose.

Astacilla longicornis (Sowerby) (Sars, 1899)

Middle somite of peraeon about twice length of anterior somites and cephalon; in female the surface (Fig. 14**D**) is covered with small tubercles, two of which are conspicuous anteriorly on dorsal surface; in male the surface is smooth and cylindrical. Female up to 30 mm body length; males up to 10 mm. There are some intertidal records at Plymouth and in Pembrokeshire, presumably of specimens washed up from below tidemarks. Recorded off most British coasts, ranging north to northern Norway east to the Kattegat and southwards to Portugal. (Two other species are recorded off Plymouth: *A. intermedia* (see Sars, 1899, as *affinis*) and *A. deshaysi* (Norman and Scott, 1906).)

Genus ARCTURELLA Sars

Body less elongate than *Astacilla* and (in females) with more tubercles and projections. Middle somite of peraeon much broader, quadrate or trapezoidal, with angled corners; subequal in length to cephalon and anterior peraeonal somites. Peraeopods 1–4 relatively sparsely setose.

Arcturella damnoniensis (Stebbing) (Stebbing, 1874, as *Arcturus*)

Head with three conical tubercles, one medio-frontal and two lateral behind it. Each peraeonal somite with a median tubercle, that of somite 4 very conspicuous with an additional tubercle behind it. Pleotelson with lateral borders deeply serrated. Female more strongly tuberculate than male and somite 4 with large triangular lobes on each side. Size up to about 10 mm body length.

Recorded from Devon and Pembrokeshire; occasionally intertidally. (One other species of *Arcturella* is recorded off the Isle of Man. This is *A. dilatata* Sars (Sars, 1899) which has a pair of large processes (not a single one) in the centre of the middle peraeonal somite.)

Family JANIRIDAE

Body oval or elongate. Eyes, when present, dorsal. Mandible usually normal (except *Microjaera*), with a strong, truncated molar process. Pleon of one small, inconspicuous somite, others all fused with telson to form a large, shield-shaped pleotelson. Uropods terminal or subterminal, with a peduncle, and generally biramous; uropods styliform, articles cylindrical not flat (Fig. 3A). In females the first pair of pleopods absent, second forming a plate-like operculum covering remaining pleopods. In males pleopods 1 form the praeoperculum, part of a copulatory structure also contributed to by second pleopods (Fig. 3A).

Key to British Genera and littoral Species of Janiridae

1. Without eyes; interstitial, body narrow
Microjaera anisopoda Bocquet & Levi (p. 60)
With eyes; not interstitial. Body wider, oval 2

2. Uropods well developed, slightly shorter or slightly longer than pleotelson, postero-lateral borders of which are serrated (Fig. 18A,C) . . . 3
Uropods small, barely if at all projecting beyond the pleotelson notch in which they are inserted. Pleotelson postero-lateral borders not serrated (Fig. 15) . . . . . (*Jaera*) 4

3. Antennae longer than body. Uropods longer than pleotelson. Peraeon somites 2 and 3 with sinuous lateral borders (Fig. 18A)
Janira maculosa Leach (p. 57)
Antennae shorter than body. Uropods shorter than pleotelson. Peraeon somites 2 and 3 with smooth lateral borders (Fig. 18C)
Janiropsis breviremis Sars (p. 58)

4. Posterior border of pleotelson barely invaginated where uropods insert (Fig. 15D); rare, ectocommensal on *Sphaeroma*
Jaera hopeana Costa (p. 52)
Posterior border of pleotelson with deep invagination where uropods insert (Fig. 15A,B,C); common, free living 5

5. Body widely oval, densely fringed with spines (Fig. 15C). Male praeoperculum narrow and pointed (Fig. 15B) . . . *Jaera nordmanni* (Rathke) (p. 52)
Body narrower, sparsely fringed with spines (Fig. 15A,B) Male praeoperculum T-shaped (Fig. 16A) . . . . . (*Jaera* "*albifrons*" group) 6

6. Male peraeopods 6 and 7 with prominent lobes on carpus (Fig. 17A)
J. albifrons Leach (p. 54)
Male peraeopods 6 and 7 without carpal lobes 7

7. Male peraeopods 6 and 7 with a cluster of curved setae on distal portion of ischium (Fig. 17B) . . . . . *J. ischiosetosa* Forsman (p. 56)
Male peraeopods 6 and 7 without curved setae 8

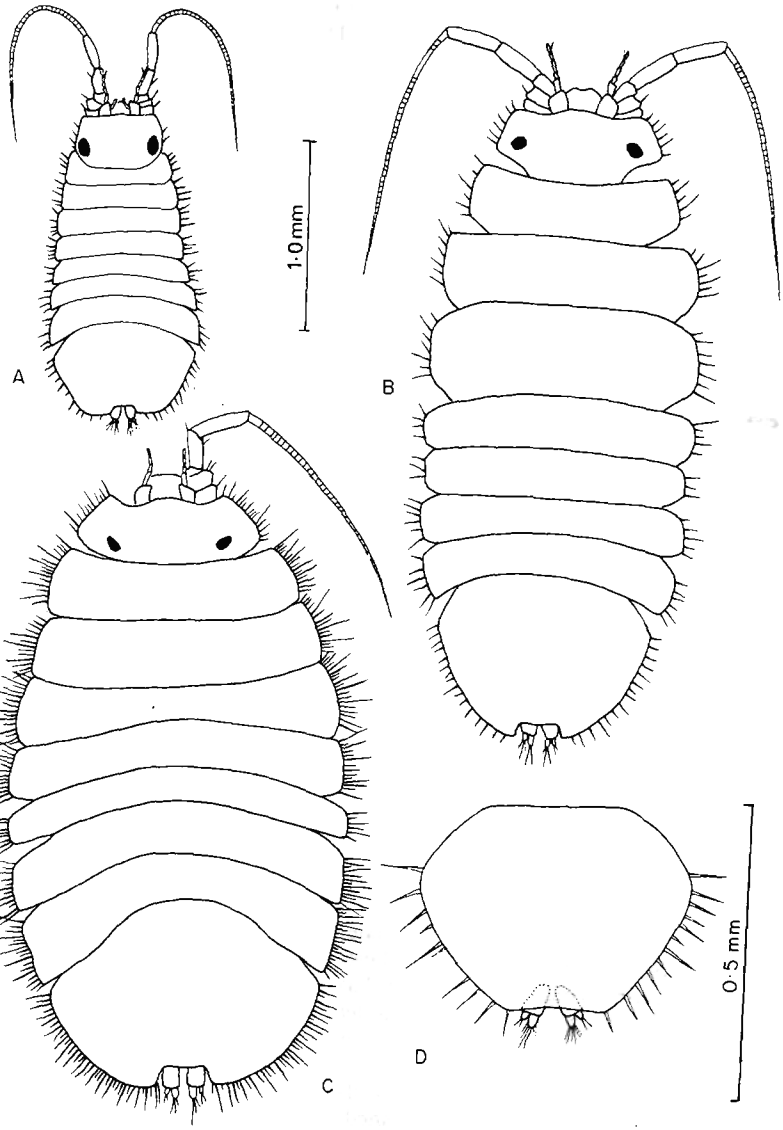


Fig. 15. *Jaera albifrons*: **A,** male; **B,** female; *J. nordmanni*, **C,** male; *J. hopeana*, **D,** male pleotelson.

8. Male peraeopods 1–4 densely covered with curved setae on propus, carpus and merus. Peraeopod 6 with carpal spine poorly developed, carpal spine of peraeopod 7 well developed (Fig. 17**D**) *J. praehirsuta* Forsman (p. 56)
Peraeopods 1–4 sparsely covered with curved setae on propus, carpus and merus. Peraeopods 6 and 7 both with carpal spine well developed (Fig. 17**C**) *J. forsmani* Bocquet (p. 54)

Genus JAERA Leach

Body broad and flattened. Antennules very small with a reduced flagellum; antennae well developed but shorter than body. Uropods small, much shorter than pleotelson and barely projecting beyond the pleotelson notch in which they are set. Coxal plates of peraeon somites not visible from above.

Jaera nordmanni (Rathke) (Bate & Westwood, 1868; Naylor, Slinn and Spooner, 1961)

Body (Fig. 15**C**) broadly oval and flattened, with sides of head, peraeon and pleotelson densely setose. Eyes small and situated fairly medially on the head. Pleotelson posterior border has a very deep invagination where the uropods are inserted. Praeoperculum of male diagnostic; narrow and pointed (Fig. 16**B**). Male body length up to about 4·5 mm; female up to 3·5 mm. Colour uniformly grey and black, paler than members of the "*albifrons*" group of species, and more transparent at the sides of the body.

Locally common, particularly on south and west coasts, under stones in freshwater streams flowing down the shore. Occupies a zone higher than *J. ischiosetosa*, ranging from MTL to HWS and above. It ranges from the Black Sea and Mediterranean south to the Azores and north to the west coast of Scotland. Lemercier (1960) recognizes three forms of *J. nordmanni*. All British forms probably belong to *J. nordmanni nordica*, distinguishable from the more southern forms *J. n. nordmanni* and *J. n. massiliensis* on small differences in the shape of the male praeoperculum.

Jaera hopeana Costa (Haahtela & Naylor, 1965)

Body fairly narrow, with very prominent spines fringing the lateral margins. Eyes small and lateral. Pleotelson of males and females has posterior border with only a very shallow invagination where the uropods are inserted (Fig. 15**D**). Praeoperculum of male is diagnostic, having narrow, elongated, terminal arms (Fig. 16**C**). Males about 1·5 mm body length; ovigerous females up to 2·0 mm. Colour, pale background with brown, in contrast to grey and black of other British forms.

So far in Britain recorded from only one locality, at Wembury (Devon), where it has evidently been established at least since the 1930's, living ecto-commensally on the ventral surface of *Sphaeroma serratum* found at HWN–MTL near a seepage of freshwater (Haahtela & Naylor, 1965). Other records are from Normandy, the Mediterranean, Adriatic and Black Sea.

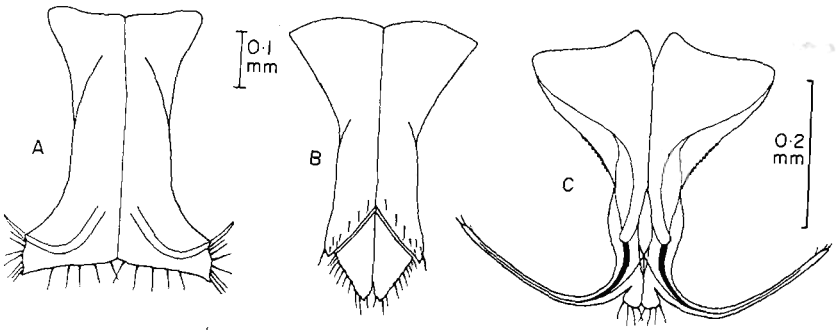


Fig. 16. Male praeoperculum of **A**, *J.* "*albifrons*"; **B**, *J. nordmanni*; **C**, *J. hopeana*.

Jaera albifrons Leach (Sars, 1899, as *marina*; Forsman, 1949, as *J. albifrons albifrons*; Bocquet, 1953, as *J. marina albifrons*)

Body narrowly oval in females (Fig. 15B); males (Fig. 15A) smaller than females and broadest across posterior peraeon somites. Lateral margins of both sexes fairly sparsely fringed with spines. Eyes large and situated laterally, particularly in males. Pleotelson posterior border fairly deeply excavate where uropods are inserted. Praeoperculum (Fig. 16A) of male T-shaped with only slight lateral extensions to each arm of the T. Peraeopods of male (Fig. 17A) diagnostic; 1–5 normal, 6 and 7 having the distal region of the carpus extended as a lobe which is fringed with spines. Typically the number of carpal spines is less than 15 but it may range up to 40 in the *syei* form of this species often found in sheltered brackish conditions.

Males up to 2·4 mm (average 1·7 mm) body length, females up to 5·0 mm (average 3·5 mm). Colour grey patterned with black in various colour varieties which have been characterized by Bocquet (1953). This, and the following three belong to the "*albifrons*" group of species. Their ecological ranges overlap but *J. albifrons* is most common at HWN on sheltered shores, often in estuaries and usually beneath stones in areas which retain surface water at low tide (Naylor & Haahtela, 1966). In the low salinity and shelter of the inner Baltic it merges into the *syei* form (Harvey & Naylor, 1967) which predominates among *Fucus vesiculosus* (Naylor & Haahtela, 1967). It is recorded from Russia to France on European coasts, and also from Greenland and eastern North America as far south as Maine (Bocquet, 1954; Jones & Naylor, 1971).

Jaera forsmani Bocquet (Bocquet, 1953, as *J. marina forsmani*)

Structurally resembles *J. albifrons* except in the nature of the peraeopods of adult males (Fig. 17C); 1–4 possess a few (usually 6 or less) curved setae on the propus, carpus and merus, 6 and 7 have no carpal lobe but have well developed spines in its place. Larger than the other species in the "*albifrons*" group: females up to 6·0 mm males up to 3·4 mm.

In Britain this species is the least tolerant of reduced salinity and is thinly distributed beneath stones in well-drained areas from HWN–LWS (Naylor & Haahtela, 1966). As yet known from Brittany, southwest England, South Wales and the Isle of Man; not recorded in the Baltic (Naylor & Haahtela, 1967).

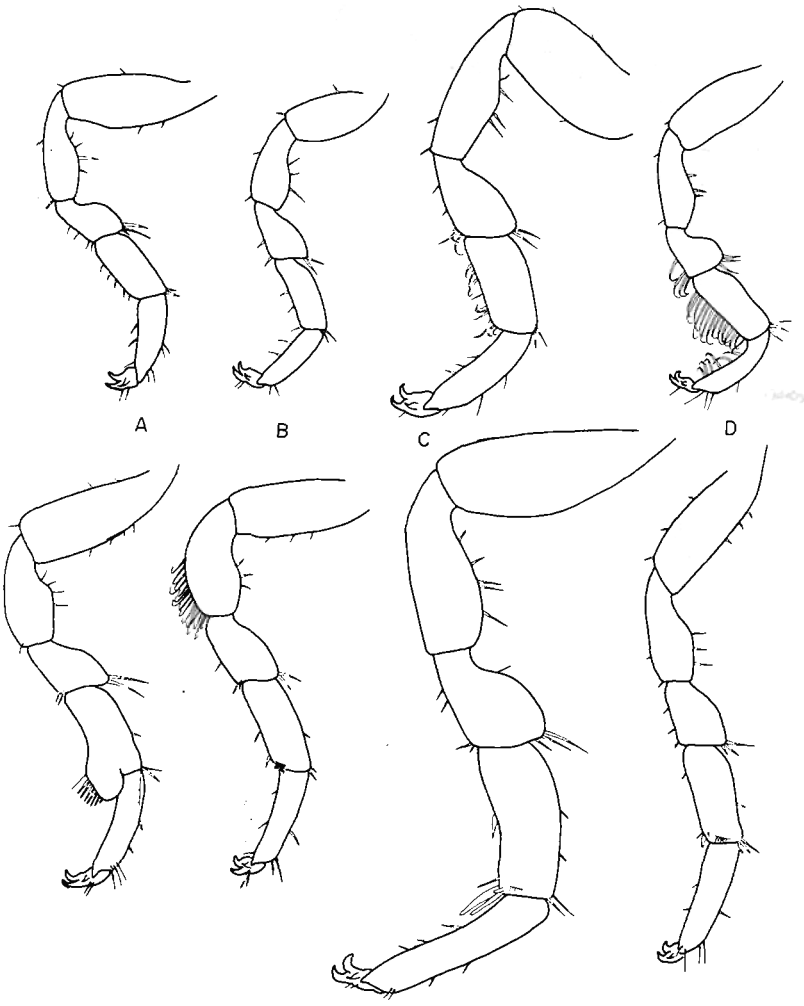


Fig. 17. Peraeopod 2 (top row) and peraeopod 6 (bottom row) of **A,** *J. albifrons*; **B,** *J. ischiosetosa*; **C,** *J. forsmani*; **D,** *J. praehirsuta*.

Jaera ischiosetosa Forsman (Forsman, 1949, as *J. albifrons ischiosetosa*; Bocquet, 1953, as *J. marina ischiosetosa*)

Structurally similar to *J. albifrons* but with diagnostic features relating to the adult male peraeopods (Fig. 17**B**); 1–4 normal, 6 and 7 each with a dense cluster of curved setae on the distal portion of the ischium. Females up to 5·0 mm, males up to 2·7 mm.

Among British members of the "*albifrons*" group this species is the most tolerant of reduced salinity. It occurs beneath stones in strong streams flowing over sheltered shores, normally ranging from LWN to above HWN, but it may be less abundant above HWN in localities where *J. nordmanni* is present (Naylor & Haahtela, 1966). It ranges from the coasts of Brittany, northwards to Russia (Bocquet, 1954) and extends well into the Baltic where it occurs abundantly under stones on Finnish shores where salinities are permanently as low as 4–5‰ (Naylor & Haahtela, 1967).

Jaera praehirsuta Forsman (Bocquet, 1953, as *J. marina praehirsuta*)

Structurally resembles *J. albifrons* but with diagnostic peraepods (Fig. 17**D**); 1–4 with many curved setae on the propus, carpus and merus, 7 but not 6 with a large spine on the carpus. Unlike *J. forsmani* the carpal spine of peraeopod 6 is small. Males up to 3·0 mm body length, females up to 4·5 mm.

This species is most common at HWN and below, mainly among algae such as *Fucus serratus* (Bocquet, 1953; Naylor & Haahtela, 1966). It ranges from sheltered marine shores to estuaries, but is patchy in its distribution in the low salinity waters off Finland (Naylor & Haahtela, 1967). Occurs in Europe from France to Norway, including the Baltic, Greenland and the Atlantic coast of North America (Bocquet, 1954).

Genus JANIRA Leach

Body oblong and flattened. Antennules well developed, with a multicarticulate flagellum; antennae longer than the body, with a "scale" on the outside of the peduncular article 3. Pleotelson postero-lateral borders serrated. Uropods well developed, longer than, or more or less equal in length to, the pleotelson. Adult male with peraeopod 1 normal, subequal to others; praeoperculum expanded only slightly at the tip (Fig. 18**B**). Coxal plates visible from above on most peraeon somites.

Janira maculosa Leach (Sars, 1899)

This species (Fig. 18**A**,**B**) is the sole representative of the genus in Britain. Notable characters for identification are the very long antennae and uropods (but note that these may often be damaged) together with the shape of the male praeoperculum (Fig. 18**B**). Another apparently consistent character is seen in the somewhat excavate sides of the anterior peraeon somites which, together with bilobed coxal plates, give peraeon somites 2 and 3 sinuous lateral borders (Fig. 18**A**). Male body length up to 10 mm; females up to 7 mm. Colour yellowish, mottled with red or brown, often with an unpigmented band across the cephalon anterior to the eyes.

A species to be looked for among sponges, ascidians, coelenterates, polyzoans, *Laminaria* holdfasts, etc. mainly in dredged material but not infrequently taken between tidemarks. A subarctic-boreal form most commonly recorded from northern Norway to the Atlantic coast of France, not ranging into the Baltic. In Britain and Ireland it has been recorded on most coasts.

Genus JANIROPSIS Sars

Resembles *Janira*, but with antennae shorter than body, uropods shorter than pleotelson and coxal plates less distinct when viewed from above. In addition the adult male has peraeopod 1 and antennal peduncle larger than in female, while the male praeoperculum is flat and expanded at the tip with acute corners (Fig. 18**D**).

Janiropsis breviremis Sars, 1899

Likely to be confused with *Janira maculosa* but differing from that species in the smoother lateral outline of peraeon somites 1–4 (Fig. 18**C**) and the characteristic male praeoperculum (Fig. 18**D**). In general, too, the uropods and antennae are shorter than in *Janira*, but antennae show sexual differences in size and are also easily damaged. Male body length 6 mm; female 4 mm. Like *Janira maculosa* found among sponges, coelenterates, bryozoans, tunicates, *Laminaria* holdfasts etc. usually well below tidemarks. Included here as a species to be looked out for since it has been recorded on the shore in southwest Ireland and also among cast up material on the Dutch coasts. In Britain recorded from Liverpool Bay, from collections made by diving off Anglesey by Professor E. W. Knight-Jones, and from sublittoral *Laminaria hyperborea* taken off St. Abbs Head by Mr. P. G. Moore. Other records are from southwest Ireland, North Sea, Norway, Skagerak and Kattegat (Grüner, 1965).

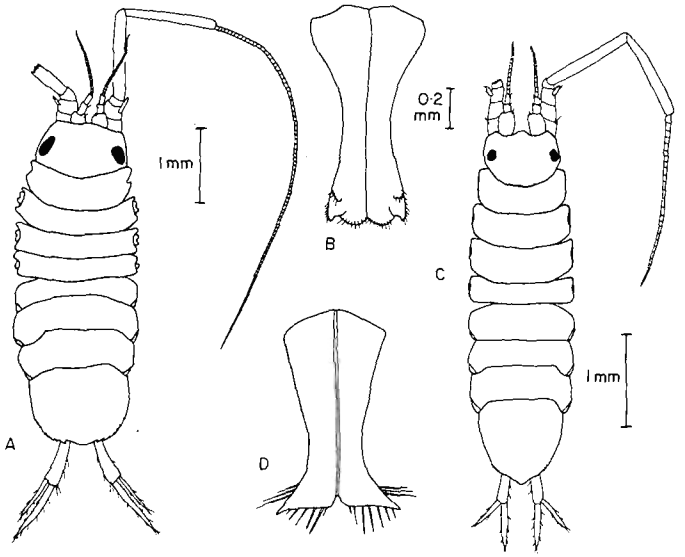


Fig. 18. *Janira maculosa* **A,** male; **B,** male praeoperculum. *Janiropsis breviremis* **C,** male; **D,** male praeoperculum.

Genus MICROJAERA Bocquet & Levi

Body elongate; head subrectangular, without eyes. Antennules very short, equal to about the length of the cephalon and composed of 5 articles. Mandible molar process a simple rounded protuberance bearing setae; left mandible with a well developed lacinia mobilis. Maxillipedal palp of 5 articles, basal 3 articles enlarged. Peraeon somite 1 large and partly embracing head, peraeopod 1 larger than remainder. Pleon of one small discrete somite; pleotelson (comprising pleon somites 2–6 and telson) oval and shield-shaped, with a sharp terminal projection. Pleopod 3 normal, 4 uniramous, 5 absent. Uropodal peduncle small, not visible from above; endopod 3 times length of exopod.

Microjaera anisopoda Bocquet & Levi, 1955

This is the type and, so far, the only species of the genus, so the generic characters readily permit identification (Fig. 19**A**,**C**). The male praeoperculum is T-shaped (Fig. 19**B**). Females 1·4 mm long, males a little smaller; length 6 times width.

This blind species is a constituent of interstitial fauna.* In Britain it has been recorded in coarse sand above MTL on Tresco, Scilly (G. M. Spooner, pers. comm.)† and sublittorally in Eddystone shell gravel (Spooner, 1959). The type material comes off Roscoff.

* For other interstitial isopods recorded offshore, see Chappuis and Delamare Debouteville, 1954, Bocquet and Levi, 1955, Spooner, 1959, 1960.

† See *J. mar. biol. Ass. U.K.*, 1960, **39**, 715.

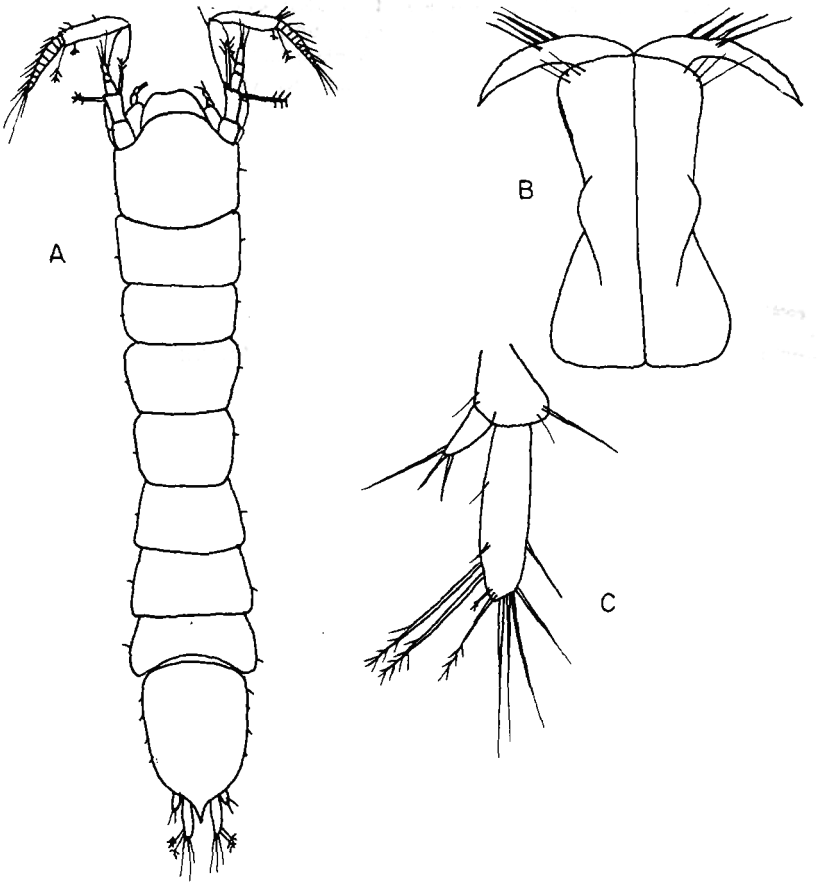


Fig. 19. *Microjaera anisopoda* **A,** female; **B,** male praeoperculum; **C,** uropod. (After Bocquet & Levi, 1955.)

Family MUNNIDAE

Body short, narrowing sharply posteriorly. European forms, generally with peraeon somites 5–7 much smaller than 1–4 and sharply marked off from them; eyes (in British spp.) on lateral extensions of the head. Molar process of mandible normal in structure, strongly developed with a truncate, denticulate grinding apex. Uropods small, lacking peduncle. Like Janiridae pleopod 1 of females absent, pleopod 2 forming plate-like operculum; male pleopod 1 forming copulatory praeoperculum contributed to by pleopod 2.

Two genera occur in British waters: *Munna* Kröyer and *Paramunna* Sars. The latter differs from the former in having shorter appendages, with the antennae less than half the body length. *Paramunna bilobata* Sars is the only recorded British species of that genus, from offshore gravel near the Isle of Man and Plymouth; it has a pronounced bilobed frontal border to the cephalon (Sars, 1899).

Genus MUNNA Kröyer

Munnidae with long or very long appendages; antennae usually at least about as long as the body. Several species have been recorded in British waters, mainly in sublittoral localities but occasionally on the shore. Descriptive notes on two species which seem to be the most commonly encountered are given below. The genus is here treated as one but it should be noted that Menzies (1957) recognizes three subgenera based on uropod characters.

Munna kröyeri Goodsir (Bate & Westwood, 1868, as *M. whiteana*; Sars, 1899; Carton, 1961)

Munna with antenna subequal in length to body, flagellum shorter than peduncle; peraeopods relatively robust (Fig. 20A). Pleotelson with 2–6 large spines visible from above on each lateral border, posterior border not serrated (Fig. 20**B**); uropod with distal, inward pointing, hooked process (Fig. 20**D**). Male praeoperculum as in Fig. 20**C**, **C′**. Females up to about 3 mm long, males smaller, e.g. 1·7 mm.

Predominantly sublittoral among sessile coelenterates, polyzoans, *Laminaria* holdfasts, etc., but recorded at LWS in the Isle of Man, St. Brides Haven, South Wales (personal collections) and on White Island, Scillies (collected by Professor L. A. Harvey). Other records are from Iceland, Norway and Scotland.

Munna minuta Hansen (Sars, 1899, as *M. fabricii*; Bate & Westwood, 1868, as *kröyeri*; Carton 1961)

Resembling *M. kröyeri* but with relatively more slender appendages (Fig. 20E). Antennae almost twice the length of the body. Pleotelson with no more than one large spine on the lateral borders; postero-lateral borders serrated (Fig. 20**F**). Male praeoperculum as in Fig. 20**G**; females scarcely reaching 3 mm body length; males smaller. Habitat similar to that of *M. kröyeri*. Recorded off most British coasts and, intertidally, at Plymouth. Also from Greenland, North America, Iceland, Spitzbergen and Norway.

Material which does not agree with these two short descriptions, particularly with regard to the male praeoperculum, should be referred to Carton (1961). There are, for example, some intertidal records of *Munna limicola* Sars which require confirmation, while G. M. Spooner pers. comm.* has recorded *M. petiti* Amar (1948) intertidally at White Island, Scilly. Two other species to look out for are *M. fabricii* Kröyer (nec *M. fabricii* Sars) and *M. armoricana* Carton.

* See *J. mar. biol. Ass. U.K.*, 1941, **41**, 848.

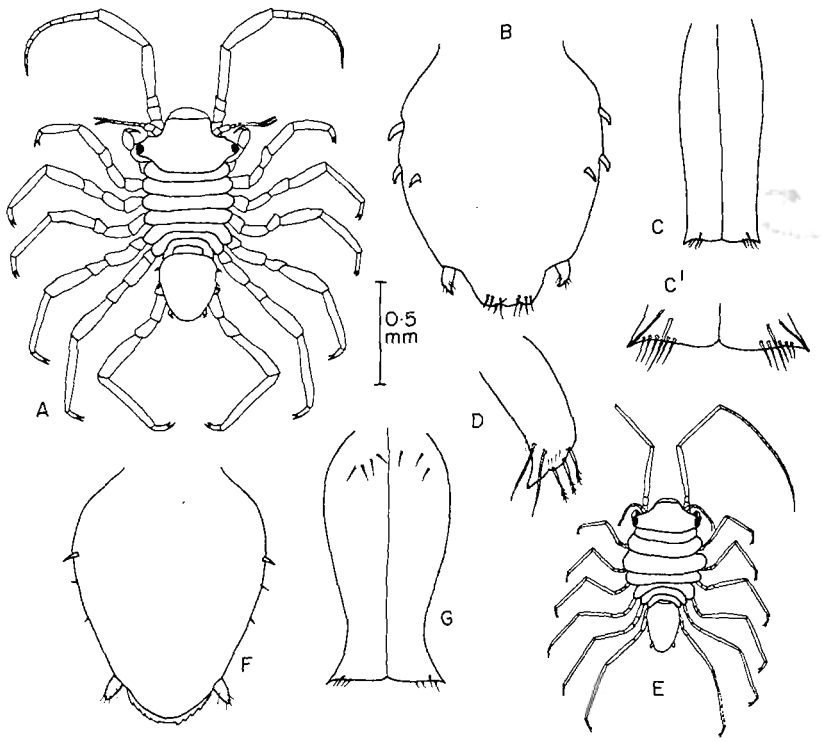


Fig. 20. *Munna kröyeri*: **A**, female; **B**, male pleotelson; **C**, **C'**, male praeoperculum; **D**, uropod.
Munna minuta: **E**, female; **F**, female pleotelson; **G**, male praeoperculum.
(**A**, after Carton, 1961; **E**, **F**, after Sars, 1899; **G**, after Hansen, 1916.)

Family PLEUROGONIDAE

Small isopods resembling Munnidae but with the molar process of the mandible reduced to narrow point. Unlike the British Munnidae, the single British *Pleurogonium rubicundum* lacks eyes. It is a northern species recorded off north-east and northwest coasts in Britain (see Grüner, 1965). Not recorded intertidally.

Family JAEROPSIDAE

Resembling Janiridae but with molar process of mandible reduced, elongate and with no grinding surface (Fig. 21**E**). In the single British species the antennae are very short with, unlike the Janiridae, the antennal flagellum shorter than the peduncle (Fig. 21**B**). Coxal plates of peraeon somites not visible from above.

Genus JAEROPSIS Koehler

Family characters applicable since this is the only genus, of which there is one British and European representative.

Jaeropsis brevicornis Koehler, 1885

Cephalon with bilobed midfrontal region and median, jointed rostral projection (Fig. 21**A**). Antennules of 5 articles, basal article particularly large with inner distal border having a transparent, serrated carina (Fig. 21**D**). Antenna very short, with flagellum shorter than peduncle (Fig. 21**B**). Uropods very small, hardly visible from above; peduncle with a serrated carina on the outer border, posterior border with an asymmetrical emargination containing the small endopod and exopod (Fig. 21**C**). Male praeoperculum (Fig. 21**F**) subtriangular. Females 2–2·5 mm body length; males 1·5 mm. Recorded intertidally from ascidians, encrusting coralline algae, bryozoans, sponges etc. on Sark, Channel Islands (Koehler, 1885), White Island, Scilly, (G.M. Spooner pers. comm.),* (L.A. Harvey pers. comm.), St. Brides Haven, South Wales (personal collections) and in Norway (W. M. Vader, pers. comm.).

* See *J. mar. biol. Ass. U.K.* 1961, **41**, 848.

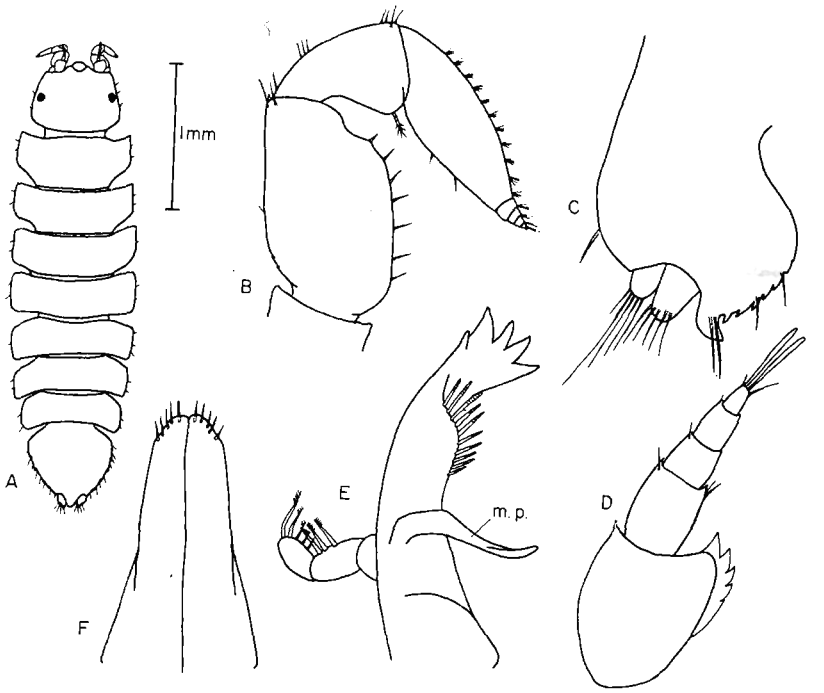


Fig. 21. *Jaeropsis brevicornis:* **A,** female; **B,** antenna; **C,** uropod; **D,** antennule; **E,** mandible; **F,** male praeoperculum. (m.p. molar process).

Family DESMOSOMATIDAE

Eyes absent. Peraeon somites 1–4 of similar width to 5–7 but latter without coxal plates. Peraeopods 5–7 for swimming, with carpus and propus flattened and fringed with smooth setae. Pleon somites usually all fused with the telson; uropods ventral, with exopod short or absent. Offshore forms (see Sars, 1899; Hansen, 1916).

Family EURYCOPIDAE

Eyes absent. Antennule basal article large and flat. Peraeon somites 1–4 each as wide as, but shorter than somites 5–7 which lack coxal plates and which, though distinct, are more or less immovably fused. Peraeopods 5–7, carpus and propus paddle-like (much wider than basal articles), fringed with plumose setae, and with terminal dactyls. Uropods ventral, biramous and barely visible from above.

Bathypelagic offshore forms (see Sars, 1899; Hansen, 1916; Naylor, 1957c).

Family MUNNOPSIDAE

Eyes absent. Body less compact than previous two families; peraeon somites 1–4 usually much broader than 5–7 which are distinct but more or less immovably fused. Peraeopods 5–7 with carpus and propus paddle-like, much wider than basal articles, fringed with plumose setae, and without dactyls. Uropods more or less terminal, uniramous and slender; visible from above.

Offshore (see Sars, 1899; Hansen, 1916; Naylor, 1957c).

Suborder ONISCOIDEA

Edney (1954) and Sutton (1971) provide keys for the identification of these terrestrial isopods. Several species are recorded in the upper shore region above HWM (Marine Biological Association, 1957), the most common and widespread of which is *Ligia oceanica* (L.) (Fig. 22). This is the largest of British woodlice, up to 30 mm long, occurring abundantly wherever there are suitable rock crevices around HWM.

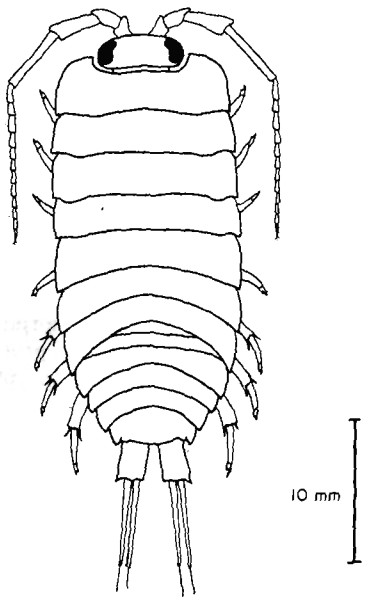


Fig. 22. *Ligia oceanica* male (after Edney).

Suborder EPICARIDEA

The Epicaridea are all parasitic forms, invariably associated with other crustaceans, and often showing extreme specialization and loss of body form in the adult. Typically there are three consecutive juvenile stages before the final host is infected (Caullery, 1922). The hatching stage is the *epicaridium* (Fig. 24I) which resembles juvenile sphaeromid isopods, with well developed cephalic, peraeonal and pleonal appendages. It has styliform, suctorial mouthparts and six pairs of clawed peraeopods enabling it to attach to the primary host which is usually a copepod. On the primary host it undergoes a number of ecdyses as the *microniscus* before eventually swimming free as the *cryptoniscus* (Fig. 24J), which resembles cirolanid isopods, and which infects the final host. Pike (1961) has shown that in the bopyrid *Athelges paguri* the epicaridium most successfully settled and developed on *Pseudocalanus elongatus*. On this preferred copepod it moulted to the microniscus stage within 8 days, and moulted three more times during a further period of about 20 days. After that time it swam free as the cryptoniscus before attaching to the final host, the hermit crab *Pagurus bernhardus*. In general in epicaridians males retain the cryptoniscus form and are to be found attached to the posterior ventral surface of large and highly modified females. It is the nature of the final crustacean host that largely determines the families of the suborder, but there are two superfamilies, the Bopyrina (Bopyridae, Dajidae and Entoniscidae) with oöstegites and the Cryptoniscina (Cryptoniscidae) without oöstegites. Sexual dimorphism is typical, in the Cryptoniscidae the cryptoniscus larva becoming a protandrous hermaphrodite on the final host. In the other three families the first cryptoniscus to settle on the final host becomes female and subsequent ones male. In all families the female is large and often asymmetrical, while the male remains cryptoniscid in form and is usually attached to the female body near the genital openings.

In view of the fact that these isopods are most often encountered on close examination of their host and are indeed best looked for by making large collections of suitable hosts, it seems reasonable here, as a preliminary means of identification, to list those British Epicaridea which have been recorded on hosts which occur or are fairly likely to turn up between tidemarks (Table 1).

TABLE I

British Epicaridea which have been found in hosts recorded from between tidemarks

Host		Position in host	Parasite	
			Species	Family
Cirripedia	*Balanus balanoides* *Elminius modestus*	Mantle cavity	*Hemioniscus balani*	Cryptoniscidae
Isopoda	*Dynamene bidentata*	Visceral cavity/ brood chamber	*Ancyroniscus bonnieri*	Cryptoniscidae
Mysidacea	*Gastrosaccus spinifer*	Brood chamber	*Prodajus ostendensis*	Dajidae
Decapoda: Natantia	*Palaeomon serratus*	Branchial cavity	*Bopyrus fougerouxi*	Bopyridae
	*Hippolyte varians** (but mostly on *Spirontocaris*)	Branchial cavity	*Bopyroides hippolytes*	Bopyridae
	Hippolyte varians	Branchial cavity	*Bopyrina giardi*	Bopyridae
Decapoda: Reptantia: Macrura	*Callianassa subterranea*	Branchial cavity	*Ione thoracica*	Bopyridae
			Pseudione callianassae	Bopyridae
	Upogebia deltaura		*Gyge branchialis*	Bopyridae
Decapoda: Reptantia: Anomura	*Pagurus bernhardus*	Abdomen surface	*Athelges paguri*	Bopyridae
	Pagurus bernhardus	Branchial cavity	*Pseudione hyndmanii*	Bopyridae
			P. proxima	Bopyridae
	Diogenes pugilator	Branchial cavity	*Pseudione diogeni*	Bopyridae
	Galathea squamifera	Branchial cavity	*Pleurocrypta longibranchiata*	Bopyridae
	Galathea squamifera and *G. intermedia*	Branchial cavity	*Pleurocrypta marginata*	Bopyridae
	Porcellana longicornis	Branchial cavity	*Pleurocrypta porcellanae*	Bopyridae
Decapoda: Reptantia: Macrura	*Pinnotheres pisum*	Visceral cavity	*Pinnotherion vermiforme*	Entoniscidae
	Carcinus maenas	Visceral cavity	*Portunion maenadis*	Entoniscidae

* In France Bourdon (1963) has also recorded *Hemiarthrus abdominalis* from *Hippolyte varians*.

Family BOPYRIDAE

The Bopyridae are parasitic in the branchial cavity or on the abdomen of decapods, mainly Macrura and Anomura. Body of female sometimes asymmetrical; peraeon with distinct somites, 7 pairs of peraeopods and 5 pairs of oöstegites, the first pair of which are bilobed; pleon somites more or less distinct. Males small, with all 7 peraeon somites distinct and pleon somites distinct or fused.

The taxonomy of the Bopyridae is particularly troublesome. Some authors consider each host to have a separate species of parasite, while other argue that this interpretation is not valid on morphological grounds. There is a clear need for a systemic revision of this family, for which the species given below have been recorded in hosts which turn up between tidemarks.

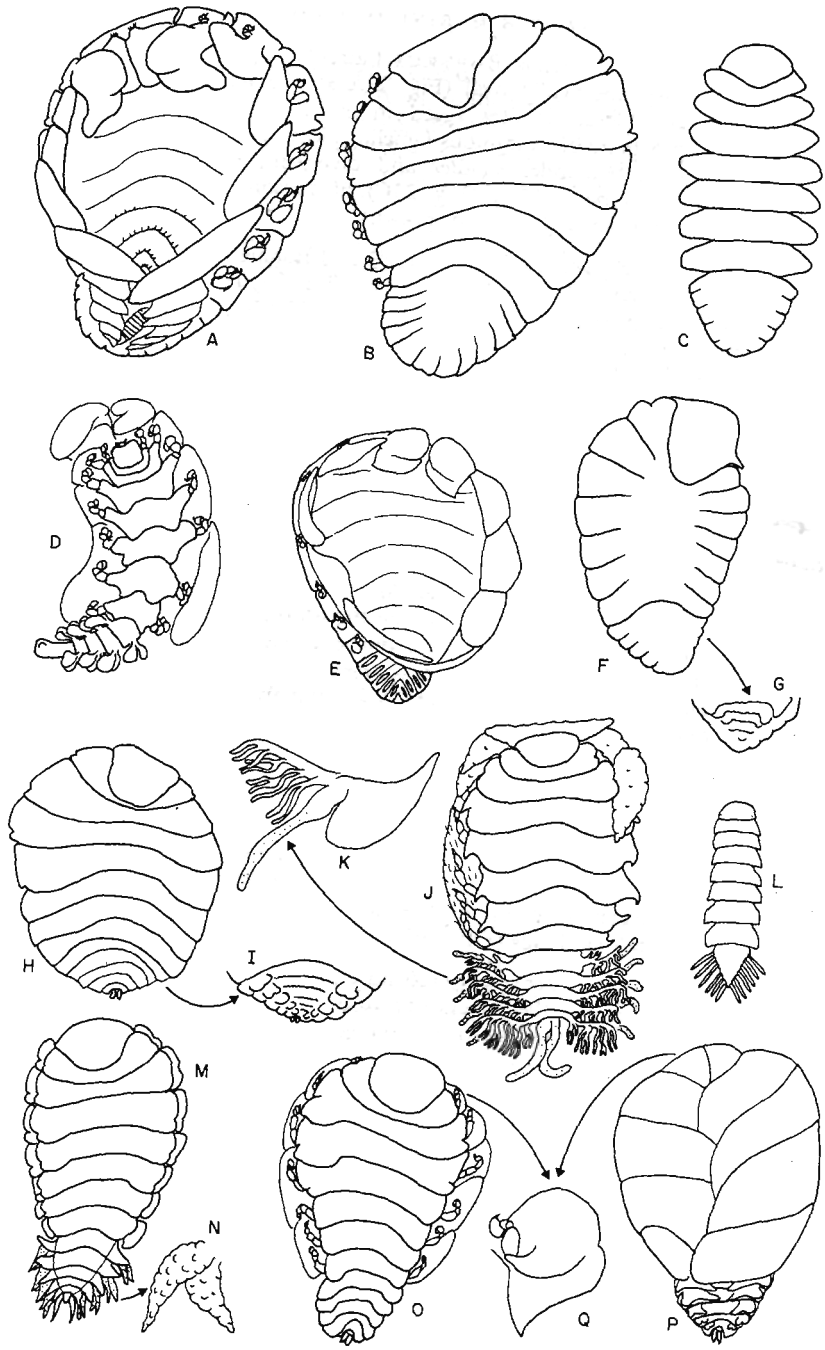
Genus ATHELGES Hesse

Fully grown female (Fig. 23D) markedly asymmetrical. Cephalon small and withdrawn into peraeon in which somites may be distinct only in the middle region, if at all. Oöstegites very large with anterior pairs elaborately folded and projecting beyond cephalon. Pleotelson narrowing abruptly, with only four distinct somites, bearing four pairs of "stalked" biramous pleopods with each ramus round and flat. Uropods barely visible, as two very small tubercles on the club-like posterior part of the pleon. Male pleotelson without somites. Parasitic on hermit crabs.

Athelges paguri (Rathke) (Sars, 1899)

This is the only species of *Athelges* recorded intertidally (Fig. 23D). Females up to 11 mm body length, males 4 mm. It occurs on *Pagurus bernhardus*, with an offshore "variety" (Pike, 1953) on *Anapagurus laevis*, usually attached to the abdomen but occasionally in the gill chamber. Laboratory settlement of the epicaridium was heavy on *Pseudocalanus elongatus* and *Acartia clausi*, but rare or absent on *Temora longicornis*, *Centropages typicus* and *Calanus finmarchicus* (Pike, 1961). The species appears to be distributed around all coasts of the British Isles and Ireland. Pike (1953) refers to three other species of this genus: *A. bilobus* Sars, *A. tenuicaudis* Sars and *A. prideauxi* Giard & Bonnier, taken respectively from the sub-littoral hermit crabs *Pagurus cuanensis* Thompson, *Anapagurus chiroacanthus* (Lillj.) and *Pagurus prideauxi* (Leach).

Fig. 23 (facing page). *Bopyrus fougerouxi:* **A**, female, ventral (with male); **B**, female, dorsal; **C**, male;
Athelges paguri, **D**, female, dorsal;
Bopyroides hippolytes, **E**, female, ventral.
Bopyrina giardi: **F**, female dorsal; **G**, ventral view of female pleon.
Gyge branchialis: **H**, female, dorsal; **I**, ventral view of female pleon.
Ione thoracica: **J**, female, dorsal; **K**, branched pleural process and pleopod with cylindrical exopod and lamellar endopod; **L**, male.
Pleurocrypta longibranchiata: **M**, female from above; **N**, biramous, tuberculate pleopod.
Pseudione hyndmanni: **O**, female from above; **P**, female from below; **Q**, peraeopod 1 and oöstegite.
(**A, B, C, F, G, H, I, J, K, L, O, P, Q** after Bonnier, 1900; **D, E, M, N** after Sars, 1899.)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Genus BOPYRUS Latreille

Female body asymmetrically oval (Fig. 23**A,B**). Peraeon somites distinct, peraeopods small. Pleon somites fused in mid-line, sides without lateral projections; with 5 pairs of uniramous lamellar pleopods and lacking uropods. Oöstegites 1, large, remainder smaller and divergent, eggs being partially enclosed by host carapace. Male (Fig. 23**C**) pleotelson with somites fused; without uropod. In branchial cavity of prawns.

Bopyrus fougerouxi Giard and Bonnier
(Sars, 1899, as *B. squillarum*; Bonnier, 1900)

The generic descriptive notes enable identification of this species (Fig. 23**A,B,C**) from the branchial chamber of *Palaemon* (=*Leander*) *serratus*, where it gives rise to the so-called "face ache" condition of the prawn. Female body length up to 11 mm, males 2 mm.

Genus BOPYROIDES Stimpson

Resembling *Bopyrus* but female pleon somites are all distinct, and pleopods are present only as 5 pairs of raised ridges (Fig. 23**E**).

Bopyroides hippolytes Kröyer (Sars, 1899; Bonnier, 1900)

Generic characters applicable for the one British representative of this genus which typically infects *Spirontocaris* taken offshore, but which has been recorded intertidally at Plymouth from *Hippolyte varians*.

Size: females up to 11 mm, males up to 2·5 mm. Recorded from Plymouth and Isle of Man; circumpolar.

Genus BOPYRINA Kossman

Resembling *Bopyrus*, but female pleon somites may show greater fusion and appears distinct on one side only (Fig. 23**F**). The female also has only 3 or 4 (not 5) pairs of uniramous pleopods, the most posterior of which may be represented only as small swellings (Fig. 23**G**).

Bopyrina giardi Bonnier, 1900

Generic characters and the presence of uropods in the male permit identification of the one British representative of the genus which typically occurs in the branchial chamber of *Hippolyte*.

Female 1·7 mm, male 0·7 mm. Recorded from *Hippolyte varians* in southwest England, Channel Islands, western Ireland (Galway) and the French coast.

Genus GYGE Cornalia & Panceri

Female body oval (Fig. 23H,I); pleon somites distinct and with small, vesicle-like uniramous pleopods on pleon somites 1–5; uropods present as a very small pair of pointed terminal projections. Oöstegites overlap ventrally in adult females. Male pleotelson with distinct somites, with distinct but small uniramous uropods.

Gyge branchialis Cornalia & Panceri (Bonnier, 1900)

This species (Fig. 23H,I) is recorded from the gill chamber of the mud-burrowing decapods *Upogebia deltaura* and *U. stellata*. The parasite measures up to 12 mm × 9 mm, males 5 mm. British records are from hosts dug at LW in mud at Salcombe Harbour, Devon, and from the Channel Islands (Pike, 1953). Southwards from there it occurs on the Atlantic and Mediterranean coasts of France and in the Adriatic. A second species, *Gyge galathea* Bate & Westwood has been recorded once, in the Channel Islands. The material has since been lost, but apart from being recorded in a different host, *Galathea squamifera*, it was reported to be scarcely different from *Gyge branchialis* (Bate & Westwood, 1868).

Genus IONE Latreille

Female (Fig. 23J,K,L) peraeon with distinct somites, which have prominent, pointed lateral projections, particularly on somites 1 and 2. Cephalon with a prominent frontal lamella. Oöstegites overlapping and covered with small, pointed projections. Pleon somites distinct, with 6 pairs of characteristic branched lateral processes, and with 5 pairs of pleopods each with a lamellar endopod and a cylindrical exopod; uropods long and tubular. Males (Fig. 23L) pleon somites fused, and with 6 pairs of characteristic unbranched processes.

Ione thoracica Montagu (Bonnier, 1900)

The generic description permits identification of this species (Fig. 23J,K,L) from the gill chamber of *Callianassa subterranea* Stebbing, a predominantly sublittoral burrowing decapod which has been dug in muddy sand in southern and western Britain. Body length of female 6–7 mm. In Britain there is an old record of the parasite from Devon and more recent ones off Plymouth (G. M. Spooner, pers. comm.) and in the Channel Islands (Pike, 1953). It also occurs on the Atlantic coast of France, Mediterranean and Adriatic.

Genus PLEUROCRYPTA Hesse

Female (Fig. 23M,N) asymmetrically pyriform. Peraeon with prominent lateral plates* which are more or less contiguous; oöstegites overlapping ventrally in adult. Pleon somites well-defined, with prominent lateral processes and well developed biramous pleopods; uropods present. Male with pleon somites fused.

In the branchial cavity of the anomuran families Galatheidae and Porcellanidae.

The taxonomy of this genus is in particular need of revision (Pike, 1953; Marine Biological Association 1957; Bourdon, 1963); three species are said to occur in hosts which are likely to turn up between tidemarks.

* Sometimes referred to as "coxal plates", but see Pike (1961).

Pleurocrypta longibranchiata (Bate & Westwood, 1868, as *Phryxus*) (Sars, 1899, *nec* Pike, 1953)

The female of this species (Fig. 23M,N) is characterized by the acute cornered cephalon and fairly long and pointed lateral plates on the pleon, beyond which project long, tuberculate pleopods. Colour pinkish in life. Male with pleon somites fused, but somewhat annulate. Females up to 8 mm, males 2 mm. Probably the regular parasite of intertidal *Galathea squamifera*. Recorded from Shetland, Isle of Man and Plymouth.

(Several species of this genus are given by Pike (1953) of which *P. marginata* Sars and *P. porcellanae* Hesse may also turn up in intertidal hosts. In *P. marginata* females the cephalon has a broad, flat frontal border, and the peraeon has very wide, flattened contiguous lateral plates. Also, the pleopods are short and smooth. In Britain it is recorded from *Galathea squamifera* from Wembury, Devon, and from *G. intermedia* in the Firth of Clyde.

Pleurocrypta porcellanae is recorded from the gill chamber of *Porcellana longicornis* from Yarmouth, Cullercoats, Firth of Clyde, Isle of Man and Blacksod Bay, Ireland. When specified the hosts came from sublittoral localities, but since this host often occurs between tidemarks the parasite should be looked out for.)

Genus PSEUDIONE Kossmann

Mature female (Fig. 23O,P,Q) more or less asymmetrically pyriform; with distinct somites on peraeon and pleon. Peraeonal lateral plates present but often small; not contiguous. Sides of pleon somites prominent and rounded; five pairs of pleopods which are biramous and lanceolate. Uropodal somite very small, uropods lanceolate. Oöstegites all large, completely enclosing brood chamber. Males with pleon of unfused somites. Pike (1953) and Bourdon (1963) list several species of this genus in European waters; they are parasitic in the branchial cavity of various anomuran decapods.

Pseudione hyndmanni (Bate & Westwood, 1868; as *Phryxus*)
(Bonnier, 1900, *nec* Sars, 1899)

In addition to the generic characters this species (Fig. 23O,P) has the pleopods smooth (not tuberculate) and not projecting laterally when seen from above. Also the maxillipede has a single very long process on the postero-lateral border, and the posterior process of oöstegite 1 (Fig. 23Q) is pointed and not incurved.

Pike (1953) gives records from northern and western Scotland, Isle of Man, Devon and Ireland, from the hermit crabs *Pagurus bernhardus* (L.) and *P. pubescens* Kröyer.

Bonnier (1900) distinguished this Bate & Westwood species from the *Pseudione hyndmanni* described by Sars (1899) and referred the Sars species to *P. proxima* Bonnier. Pike (1953) considered that British material belonged to *P. hyndmanni* but pointed out that the material in some ways resembled *P. proxima*. One Plymouth record of *Pseudione* from intertidal *Pagurus bernhardus* has been ascribed to *Pseudione proxima* Bonnier (i.e. the Sars "*hyndmanni*"). This last species differs from "true" *hyndmanni* in having long, tuberculate pleopods projecting beyond the sides of the pleon, the postero-lateral border of the maxillipede has two short processes, and oöstegite 1 has the posterior process rounded and incurved (see Pike, 1953). *Pseudione* is a particularly problematical genus clearly in need of revision. A third species recorded from the "left-handed" hermit crab *Diogenes pugilator* in southern Britain is *Pseudione diogeni*. Three other sublittoral species recorded at Plymouth include *P. callianassae* from offshore *Callianassa subterranea*.

Family ENTONISCIDAE

Almost always in the visceral cavity of Anomura and Brachyura, surrounded by a membrane of host origin and communicating with the branchial cavity of the host by a pore. Together with this endoparasitic habit the family has extreme morphological specialization; the female body has only indistinct traces of somites, and peraeopods are rudimentary or entirely absent. Five pairs of oöstegites are present, arising somewhat dorsally owing to the considerable reduction of the dorsal body surface.

A poorly studied family, so far known to be represented by only three species in British waters. Of these, *Entionella monensis* Hartnoll occurs offshore in the spider crab *Eurynome aspera* (Hartnoll, 1960), and only two species have been recorded from hosts which occur intertidally, namely *Pinnotherion vermiforme* from the pea-crab *Pinnotheres* (see Atkins, 1933), and *Portunion maenadis* from the common shore crab *Carcinus*.

Pinnotherion vermiforme Giard & Bonnier
(Nierstrasz & Brender à Brandis, 1926; Atkins, 1933)

Female (Fig. 24**A**,**B**) with peraeon very short; ovary without external dorsal processes, but with two ventral processes, the posterior of which is long and often extends into the host pleon. Oöstegites 2–5 boundaries difficult to distinguish in ripe female, forming a brood pouch enclosing ovarian lobes and oöstegite 1. Oöstegite 1 with anterior and unusually long posterior lamellae only; transverse lamellae absent. Colour violet or white. Male (Fig. 24**C**) free in the peraeon and pleon of host, on the female abdomen, or in the female brood pouch; length 1–3·5 mm.

Atkins' (1933) records are from *Pinnotheres pisum* infecting the mussel *Mytilus* and were collected from Camel Estuary, northern Cornwall. About 28% of the crabs were parasitized, and of 189 parasites found 17 were at the cryptoniscus stage, 168 were male and 4 were female.

Portunion maenadis Giard (Nierstrasz and Brender à Brandis, 1926)

Female (Fig. 24**D**,**E**) with peraeon fairly long; ovary with two ventral and two dorsal processes. Oöstegites 2–5 covering ovarian processes and oöstegite 1; the latter with anterior, posterior and transverse lamellae. Size 3·2 cm. Male resembling that of *Pinnotherion* but with peraeon somite 1 more distinct from cephalon. In Britain, recorded once near Plymouth from a male *Carcinus maenas* (L.) (Marine Biological Association, 1957).

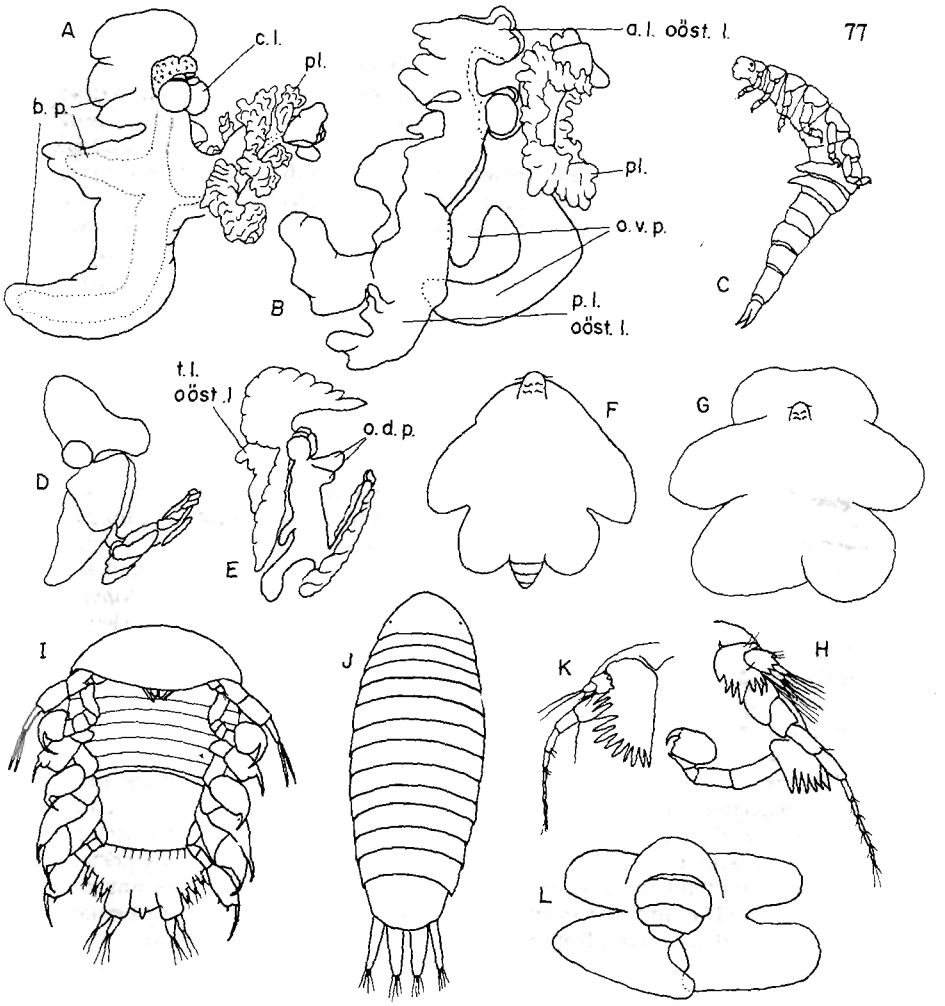

Fig. 24. *Pinnotherion vermiforme:* **A,** entire female; **B,** brood pouch (oöstegites 2–5) removed to reveal oöstegite 1 and ventral ovarian processes; **C,** male.
Portunion maenadis: **D,** entire female; **E,** brood pouch removed.
Hemioniscus balani: **F,** developing female; **G,** mature female; **H,** antennule, antenna and peraeopod 1 of male.
Ancyroniscus bonnieri: **I,** epicaridium; **J,** cryptoniscus (=male); **K,** antennule and antenna of male; **L,** female.
(*a.l. oöst.* 1 anterior lamella of oöstegite 1, *b.p.* brood pouch, *c.l.* cephalic lobe, *o.d.p.* ovarian dorsal process, *o.v.p.* ovarian ventral process, *p.l. oöst.* 1 posterior lamella of oöstegite 1, *t.l. oöst* 1 transverse lamella of oöstegite 1.
(**A, B, C** after Atkins, 1933; **D, E** after Nierstrasz & Brender á Brandis, 1926; **F** after Sars, 1899; **H** after Bonnier, 1900; **I–L** after Holdich, 1968c.)

Family DAJIDAE

Parasitic in the incubatory chamber or on the dorsal surface of mysids and euphausiids, and rarely on Brachyura. Female with body symmetrical; somites, when present, visible only in the mid-dorsal region; peraeopods well developed but numbering only 5 pairs and crowded near the mouth; oöstegites present but small with brood pouch often appearing bilateral; pleopods small or absent. A poorly known family, the hosts of which are essentially planktonic (see Sars, 1899) though it should be noted that surf plankton mysids are sometimes stranded between tidemarks. R. Hamond (pers. comm.) provisionally records three epicaridian larvae from the mysid *Gastrosaccus spinifer* stranded on the Norfolk coast as the first British record of *Prodajus ostendensis* Gilson (Nierstrasz & Brender à Brandis, 1926; Holthuis, 1956).

Family CRYPTONISCIDAE

Recorded particularly from barnacles, isopods and ostracods. Female stage sac-like, with few distinct somites and lacking peraeopods. Male (cryptoniscus) antennule with basal article lamellar and often serrated; peraeopods 3–7 usually slender with setiform dactyls; pleopods and uropods biramous. Unlike the Bopyridae, Entoniscidae and Dajidae which comprise the super-family Bopyrina, the Cryptonicidae lack oöstegites and incubate the brood internally. They are protandrous hermaphrodites, the cryptoniscus stage being male and the final highly modified stage being female.

Several species occur on French coasts (Bourdon, 1963) but only three of these have so far been recorded in Britain; one is sublittoral and two occur intertidally. The sublittoral species *Liriopsis pygmaea* Rathke parasitizes *Peltogaster paguri*, a parasitic barnacle itself attached to the abdomen of the hermit crabs *Anapagurus laevis* and *Eupagurus cuanensis* (Marine Biological Association, 1957; Bruce, Colman and Jones, 1963). The female stage of *Liriopsis* is a constricted sac with an anterior lobe buried in the host and a projecting posterior lobe; the cryptoniscus lacks serrations on the basal article of the antennule (Sars, 1899). The littoral species are *Hemioniscus balani* from shore barnacles and *Ancyroniscus bonnieri* from the shore isopod *Dynamene bidentata*.

Genus ANCYRONISCUS

Ancyroniscus bonnieri Caullery & Mesnil (Holdich, 1968c)

The adult female, protandrous male (cryptoniscus) and newly released epicaridian larva are illustrated in Fig. 24**I,J,K,L**. The intermediate microniscus stage and its host are unknown. Up to 4 protandrous males (0·7 mm long) have been found in the visceral cavity of both males and females of the host, the sphaeromid isopod *Dynamene bidentata* (see p. 35). Further development of the parasite occurs only if the host is female. One male develops as the female after attaching to the gut, then protruding the head and anterior pleon into the host brood pouch which it often fills. Infected *Dynamene* females usually lose their own eggs, the eggs of the parasite then being visible through the host cuticle. Release of embryos is facilitated by a ventral split in the external part of the peraeon of the parasite, epicaridian larvae (0·19 × 0·12 mm) escaping via the host brood pouch.

Unevenly distributed in *Dynamene* in its range on South and West coasts: South Devon populations with 10% infection, Bristol Channel populations 2%, none from *Dynamene* in Anglesey and the Isle of Man (Holdich, 1968c). One cryptoniscus from *Dynamene* in Ireland (Tattersall, 1906) was presumably this species.

Genus HEMIONISCUS Buchholz

Hemioniscus balani (Spence Bate) (Sars, 1899, as *Cryptothir*; Nierstrasz & Brander à Brandis, 1926)

Female stage (Fig. 24**F,G,H**) with middle part of body sac-like, having two or three lobes on each side; head present as a small conical projection still retaining appendages for attachment; posterior region also cone-like and with some evidence of somites particularly in maturing females. Cryptoniscus (male) with antennule biramous. Female reaching 8 mm body length.

Adults in the mantle cavity of the shore barnacles *Balanus balanoides* and *Elminius modestus*. In Britain recorded on western coasts but particularly in southwest England where up to about 90% infection of *B. balanoides* has been recorded. On French coasts it has also been recorded from *Chthamalus stellatus* and *Balanus perforatus* (Bourdon, 1963). Recently this species has been recorded in Norway (Vader, 1968), ten degrees of latitude north of its previously recorded range.

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Notes