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Fiches d'Identification du Plancton

LEAFLET NO. 181

To replace *Fiches d'Identification du Zooplancton* No. 12

Copepoda
Sub-order: Calanoida
Family: Acartiidae
Genera: *Acartia, Paracartia, Pteriacartia*

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Family Acartiidae

Introduction

Copepods of the family Acartiidae are common inhabitants of coastal and estuarine environments in all oceans of the world. They are thought to be mainly adapted to high food concentrations, which are encountered in estuaries and upwelled waters. For example, *Acartia tonsa* cannot obtain sufficient food for reproduction on the middle and outer shelf, where food concentrations are usually low, because clearance rates decrease when food concentrations fall below a certain level (Paffenhöfer and Stearns, 1988). Their distribution in space and time may owe a lot to the fact that a number of *Acartia* species are known to produce diapause eggs which allow them to lie dormant in the sediment and to appear suddenly in the plankton when conditions are favourable (e.g., Uye, 1983, 1985; Lindley, 1990; Næss, 1991; Belmonte, 1992, 1997, 1998; Viitasalo and Katajisto, 1994) or to be transported in ships' ballast water to other parts of the world (Hirakawa, 1988). It is also recognized that morphological anomalies may be created in polluted environments (e.g., Brylinski, 1984).

Farran's (1948) review of *Acartia* for *Fiches d'Identification du Zooplancton* (No. 12) now needs revision, since a number of species and a genus have been described since then. The present review, based mainly on the existing literature, covers species known to occur in the North Atlantic and Mediterranean seas, and also includes notes and figures of related species from other temperate northern hemisphere areas because of the possibility that species could be transported from one area to another in ships' ballast water.

Steuer (1915, 1923) divided the family into *arostratae* and *rostratae* and further subdivided them into subgenera. More work needs to be done on the validity of Steuer's divisions. The taxonomy of the Acartiidae would probably benefit from further study of the nature of the female genitalia now that evolutionary trends in copepod genitalia are better understood (Barthélémy *et al.*, 1998). Steuer (1923) noticed certain differences between groups, based on the few species he studied. The European fauna contains many of Steuer's groups, and a number of species in the fauna need to be redescribed, as it was difficult to obtain realistic illustrations of some species. Recently, a new genus (*Pteriacartia* Belmonte, 1998b) has been described to take *Paracartia josephinae*.

Acartia elmaghraby appears to be a *nomen nudum*, and an original description of *A. setigera*?, mentioned by Kovalev and Shmeleva (1982), could not be located. Therefore these two "species" are not included here.

There is also a need for further work on the exact number of species in the North Atlantic and Mediterranean acartiid fauna. It is clear that the last word has not been said on the number of sibling species present nor on the range of variability to be found within one species. McKinnon *et al.* (1992), studying plankton from Port Phillip Bay, Victoria, Australia, show that there are three size morphs of *Acartia*. These are very similar in characters other than size and exhibit fixed gene differences. The authors conclude that these morphs are separate species. There is also a need to re-examine the status of some species which have been recorded commonly since their original description (e.g., *A. clausii*). Only when these taxonomic problems have been worked out can meaningful physiological and ecological conclusions be drawn concerning members of this family.

A number of additional references, to aspects of feeding, diet, reproduction, reproductive success, population biology, ecology, inter-annual variability of populations, and effect of preservation on morphology, biomass, and biochemical composition, are not recorded here. These can be accessed through electronic or paper abstract databases.

Key to abbreviations: A1 = antennule; A2 = antenna; B1 = coxa; B2 = basis; Mn = mandible; Mx1 = maxillule; Mx2 = maxilla; Mxp = maxilliped; P1–5 = swimming legs 1–5; Re = exopod; Ri = endopod. The spine and setal formula of the swimming legs is given in the mode of Sewell (1949). The spines (Roman numerals) and setae (Arabic numerals) are numbered from proximal to distal on each branch of the limb, and from outside to inside on each segment.

Superfamily Diaptomoidea

Family Acartiidae Sars, 1903

Female: Small, more or less slender copepods. A single eye present. Head and pedigerous somite 1 separate, pedigerous somites 4 and 5 always fused, posterolateral corners of the prosome rounded or pointed. Urosome of 3 free somites, anal operculum may be on the anal somite or the anus may open between the last two urosomites into a dorsal grove on the anal somite; caudal rami generally slightly asymmetrical, short or long, sometimes fused with the anal somite, with 6 setae. Without a rostrum with or without paired filaments. Upper lip large, prominent, and trilobed. A1 17–22-segmented, many segments with long setae. A2 Ri 3-segmented; B2 (with 1 seta) and Ri1 are fused, the resulting segment bears 9 setae arranged in a proximal group of 8 and an isolated distal seta, the 8 proximal setae are interconnected at their bases by tiny tendinous strands extending from a single muscle inserted adjacent to the last seta

enabling the 8 setae to be moved as a single unit (*Acartia*); Ri2 with 6–9 distal setae; small terminal segment with 7 terminal setae; Re with reduced number of segments: 4-segmented with 1, 2, 2, 3 setae, respectively. Mn with well-developed gnathobase with a large separate tooth on one border, palp B2 with 1-2 setae; Ri 1-segmented with 2 + 8–9 setae; exopod 5-segmented with 1, 1, 1, 1, 2 setae, respectively. Mx1 with reduced lobes and setation; praecoxal arthrite short with about 6–8 spines and setae, coxal endite, and basal endites 1 and 2 with 0, 3, 1 setae, respectively; Ri apparently absent; Re with 2 + 5 setae; coxal epipodite 1 and basal exite with 8–9 and 1–0 setae, respectively. Mx2 endites 1–5 with 3–4, 2–3, 2–3, 1–3, 1–2 setae, respectively; Ri with 4–5 setae. Mxp reduced and highly modified, B1 with 5–6 long setae; B2 with 1 short thick seta; Ri with fused segments with 4–5 short thick setae. P1–4 slender and delicate with long natatory setae; distolateral borders of Re of P2–4 expanded into a conspicuous tooth; articulated spines are not present in this position. P1 B2 may have a small outer edge spine or seta; terminal Re spine of P2–4 with outer edge teeth. Spine and seta formula as follows:

	B1	B2	Re segments	Ri segments
P1	0–0	1/0–0	I–1; I–1; II, I, 4	0–1; 1, 2, 3
P2	0–0	0–0	0–1; 0–1; 0, I, 5	0–2; 1, 2, 4
P3	0–0	0–0	0–1; 0–1; 0, I, 5	0–2; 1, 2, 4
P4	0–0	1–0	0–1; 0–1; 0, I, 5	0–2; 1, 2, 3

Female P5 usually uniramous, small, symmetrical, 3-segmented, B1 and intercoxal sclerite may be fused or B1 and 2 and the intercoxal sclerite may be fused (*Paracartia, Pteriacartia*); B2 with an outer seta; Re in the form of a spine or elongate seta; small Ri present in *Acartiella*.

Genus *Acartia* Dana, 1846

As for the family, with the following additional characters. Anal somite is without an anal operculum, as anus opens between last two urosomites into a dorsal grove on anal somite. Caudal rami are short, separated from anal somite. A2 B2 is fused with Ri1, which is long and slender and bears 9 setae; Re is shorter than Ri1. P1 Re1 and Re2 each with a long slender outer distal spine, and with 2 spines on Re3. Female P5 3-segmented, uniramous, with last segment modified into a long, slender spine. Male P5 is larger on right, Re2 with a large inner lobe, and Re3 in the form of a clasper (Bradford, 1976).

Subgenus *Acartiura* Steuer, 1915

As for the genus, with the following additional characters. Ovaries fused. Last prosomite is rounded but may bear spines. Rostral filaments absent. Caudal rami are short and slightly asymmetrical, with right ramus longest. Female genital double-somite with spermathecal canal looped when viewed both laterally and ventrally, and genital apertures are close together on ventral surface. Female P5 has a smooth terminal spine bearing some distal hairs on both sides and with an evenly bulbous base, Ri absent. Male P5 has right B2 with 2 inner ridges and an outer distal plumose seta, Re1 usually (not in *A. discaudata*) has a distal inner lobe and a proximal inner spine, Re2 has its inner lobe bearing 1–3 spines, Re3 has a terminal spine, and inner edge spine and at least 3 transverse rows of outer spines; left B2 has an inner proximal ridge, left B2 has an inner proximal ridge, posterior surface spines, and an outer distal plumose seta; Re1 usually has some spinules; the Re2 + 3 is shaped like a hand with 2 lateral distal opposing spines, anterior spine much heavier and thicker-walled than posterior spine, but both are simple; patches of spinules and hairs are proximal to anterior spine. Mainly temperate to cold species in both hemispheres (Bradford, 1976).

1. *A. clausii* Giesbrecht, 1889. Female: length 0.81–1.47 mm. Posterior prosome bordered with 2–4 strong spines dorsally and some stiff hairs ventrally. Right caudal ramus length:width is 1.83–2.08. Genital double-somite and urosomite 2 is bordered posterodorsally with conspicuous spines. Genital double-somite length:width is 1.10–1.20, in dorsal view widest part is on anterior one-third of somite, and genital swelling is centrally placed in lateral view. A1 slightly shorter than prosome, segment 5 with a distinct denticle anteriorly. P5 terminal spine thick. Male: 0.71–1.31 mm. Posterior prosome bordered by dorsal spines and ventral stiff hairs, genital somite bordered by posterodorsal hairs, urosomites 2–4 bordered by posterodorsal small spines, and urosomite 2 has small spinules laterally. Right caudal ramus length:width is 1.02–1.24. B2 of left P5 with 2 rows of small spines, 1 row on inner edge ridge, other on posterior surface; Re1 with some anterior surface spinules and inner edge hairs, Re2 + 3 shorter than Re1 with a slightly convex distal border and length of posterior spine just less than half that of its segment and longer than anterior spine inserted distal to anterior spine; right Re1 inner distal lobe with proximal border at right angles to rest of segment, Re2 inner lobe with 1 distal and 1 proximal spinule and distoposterior knob (Sars, 1903; Bradford, 1976).

2. *A. discaudata* (Giesbrecht, 1881). Female: 1.2 mm. Posterior prosome rounded and smooth. Urosome without any trace of spinules or denticles; genital double-somite large, conspicuously dilated anteriorly in dorsal view, and centrally in lateral view; urosomite 2 terminates in a rounded protuberance; anal somite flattened and considerably expanded distally; caudal rami

of a rounded oval form with marginal setae comparatively short and conspicuously dilated at their base. A1 extends slightly beyond posterior border of prosome, without any anterior denticles on segment 5. P5 resembling those of *A. clausii*. Male: 1.10 mm. Caudal rami not oval. P5 large, right leg very elongated, being twice as long as left leg with lamellar expansions inside B2, Re1, and Re2 comparatively small, Re3 narrow, almost claw-like; left B2 bearing two rows of spinules, the distal row composed of much larger spinules than proximal row (Sars, 1903; Bradford, 1976).

3. *A. discaudata* var. *mediterranea* Steuer, 1929. Female: 1.06–1.19 mm. Posterior prosome bordered by a variable number of teeth. Genital double-somite distinctly asymmetrical with a chitinous knob on right ventral surface posterior to genital swelling. Male: 1.08 mm. Posterior prosome bordered by teeth. P5 more richly armed than drawn by Giesbrecht or Sars, right Re2 with a shorter inner process, less distally placed than in Atlantic specimens (Steuer, 1929).

[Note: The specimens from Brest, observed by myself (Bradford, 1976), also have the male P5 more richly ornamented than that drawn by Sars (1903), although the inner process on the right Re2 is of a size and position as figured by Sars (1903). Steuer (1929) was unable to check that the ventral chitinous knob was purely a characteristic of Mediterranean specimens; work needs to be done to establish the distinctness of Mediterranean specimens of *A. discaudata*, and on the unity of this species in European waters.]

4. *A. enzoi* Crisafi, 1974. Female: 1.07 mm. Posterior prosomal borders rounded, genital double-somite with a length approximately twice that of successive somites together, in lateral view genital swelling has an irregular outline [but line drawing does not seem to agree with the photos, which seem more like *A. discaudata*]. Caudal rami are enlarged. P5 similar to *A. clausii*. Male: 1.05 mm. P5 right Re3 enlarged, bearing 3 large spines and patches of hairs; left Re2+3 with heavy spine inserted at about midlength and a fine subterminal spine (Crisafi, 1974).

[Note: This species seems to be similar in some respects to *A. discaudata*. Apparently there are no types of this species in existence (G. Belmonte, pers. comm.), so it is impossible to check its identity. This species has not been recollected since its description. I consider this to be a doubtful species.]

5. *A. hudsonica* (Pinhey, 1926). Female: 0.78–1.32 mm. Posterior prosome with some ventral hairs. Genital double-somite usually with a few irregular rows of very minute spinules on ventrolateral surfaces, posterodorsal margin without spines or spinules; urosomite 2 usually with very minute hair-like spinules on posterodorsal margin; anal somite naked or sometimes with some fine hairs on dorsal and lateral surfaces; caudal rami usually with a few small spines on outer posterodorsal margin, numerous fine hairs on lateral margin and a few minute hair-like spinules at distal end of lateral margin. Genital double-somite length:width is 1.24–1.34, with genital swelling anterior in both dorsal and lateral views, in dorsal view bulge lies entirely anterior to middle of the somite. Right caudal ramus length:width is 1.69–1.91. P5 terminal spine thick and conspicuously hairy on both sides distally. Male: 0.71–1.07 mm. Posterolateral corner of prosome with several hairs usually in two rows and more conspicuous than those of female. Urosomite 1 with lateral hairs, urosomites 2–5 with very minute hair-like spinules on dorsal and/or lateral surfaces, urosomite 5 sometimes with several fine hairs on ventral surface; caudal rami usually with a few small spines on outer posterodorsal margin, with very minute hair-like spinules on dorsal surface, and with several fine hairs on lateral and medial margins. Right caudal ramus length:width is 1.16–1.29. B2 of left P5 with 2–5 small strong spines in inner posterior surface, Re1 with indented hairy border, Re2+3 with long equal spines, about half length of the segment, each inserted at same level on segment; right Re2 inner lobe with posteriorly directed projection conspicuous when viewed ventrally and more or less visible depending on angle of view in other directions; this projection may make lobe appear slightly bilobed (Bradford, 1976; Ueda, 1986a).

6. *A. longiremis* (Lilljeborg, 1853). Female: 1.25 mm. Posterior border of prosome rounded and each side carrying a conspicuous, dorsal, delicate spinule. Urosomites clothed both laterally and on posterior borders with delicate spinules. A1 extends to middle of genital double-somite, none of segments denticulate. P5 with terminal spine slender and long. Male: 1.05 mm. P5 with right Re1 and Re2 expanded internally into rounded lamellar projections; left B1 bearing a large and a small spine (Sars, 1903; Bradford, 1976).

7. *A. margalefi* Alcaraz, 1976 (= *A. lefevreae* Bradford, 1976). Female: 0.79–0.91 mm. Posterior prosome with 2–5 small spines dorsally, urosomites naked. Genital double-somite length:width is 1.26–1.45, with genital swelling anterior in both lateral and dorsal views. Right caudal ramus length:width is 2.12–2.43. P5 terminal spine thick. Male: 0.80–0.90 mm. Posterior prosome with dorsal spines and ventral hairs, genital somite with hairs. Urosomites 2–4 naked. Right caudal ramus length:width 1.25–1.53. B2 of left P5 usually with 2 posterior rows of small spines, proximal row short, sometimes absent, Re1 with an inner border of hairs, Re2+3 about equal in length to Re1, posterior spine is slightly longer than anterior spine, posterior spine is inserted distal to anterior spine which is almost at midlength on segment and is finely toothed at its distal

end; inner distal lobe on right Re1 with proximal border almost meeting remainder of segment at right angles, Re2 inner lobe rounded with a proximal as well as a distal spine (Alcaraz, 1976; Bradford, 1976).

8. *A. omorii* Bradford, 1976. Female: 0.94–1.22 mm. Posterior prosome usually with some ventral hairs, genital double-somite naked, urosomite 2 naked or with 1–3 posterodorsal blunt teeth. Genital double-somite length:width is 0.99–1.07, with widest part anterior in dorsal view, genital swelling almost central in lateral view. Right caudal ramus length:width 1.05–1.84. P5 terminal spine thick. Male: 1.00–1.19 mm. Posterior prosome with ventral hairs, urosomites sometimes with very small posterodorsal spinules. Right caudal ramus length:width is 1.10–1.25. B2 of left P5 with a posterior row of 2–4 spines, Re1 with inner edge hairs, Re2+3 with long equal spines more than half length of segment, anterior heavy spine inserted proximal to posterior spine; right Re2 inner lobe with 2 posteriorly directed knobs which give lobe a slightly bifurcate look when viewed from certain angles, border of segment proximal to lobe is very convex, outer border has a few spinules (Bradford, 1976; Ueda, 1986b).

9. *A. teclae* Bradford, 1976. Female: 0.71–0.87 mm. Posterior prosome and urosomites naked. Genital double-somite length:width is 0.94–1.08, with swelling centrally placed in lateral view, and anteriorly placed in dorsal view. Right caudal ramus length:width is 1.71–2.20. P5 terminal spine thick. Male: 0.64–0.72 mm. Posterior prosome with ventral hairs. Urosomites naked. Right caudal ramus length:width is 1.15–1.30. B2 of left P5 with 2 posterior rows of medium-sized spines and inner border with hairs, Re1 with inner edge hairs, Re2+3 about equal in length to Re1, spines short, posterior spine inserted distal to anterior spine and slightly longer than anterior spine which is placed at about midlength; right B2 with very conspicuous ridges, Re2 inner lobe angular because of 2 expansions at end, distal posterior expansion smallest (Bradford, 1976).

Subgenus *Acanthacartia*

Rostral filaments usually present. Ovaries fused. A1 segments mostly unspined. Posterior prosomal borders rounded and either naked or armed with spines, sometimes large and acute. Spermathecal canal appears to be looped only in ventral view. P5 as in *Acartiura*, although heavy spine on male left Re2+3 is not simple spine found in *Acartiura* but may have one or more accessory spines arising from its base or be expanded. Coastal species (Steuer, 1915, 1923; Bradford, 1976).

10. *A. bifilosa* (Giesbrecht, 1881). Female: 1.02–1.10 mm. Posterior prosome rounded. Genital double-somite and urosomite 2 with the dorsal surface covered with fine hairs arranged in rows across the somite. A1 without spines, not extending beyond posterior border of genital double-somite. P5 B2 longer than wide, terminal spine twice length of its segment, nearly straight, in the form of a stiletto and a little longer than outer plumose seta. Male: 1.0–1.1 mm. Urosome without spines. P5 similar to that of *A. clausii*, but right Re1 has two inner expansions, and a small, heavy appendix on left Re2+3 (Giesbrecht, 1892).

11. *A. bifilosa* var. *inermis* Rose, 1929. Female: 1.1 mm. Urosomites without fine hairs. The terminal spine of P5 about same length as plumose seta. Male: 1.1 mm. External posterior border of urosomites 1 and 2 sometimes with hairs. P5 as in *A. bifilosa* (Rose, 1929).

12. *A. fossae* Gurney, 1927. Female: 1.03–1.40 mm. Posterior prosome border rounded, with a row of 4–5 small teeth. Genital double-somite as wide as long, longer than urosomites 2 and 3 combined, with a few small lateral hairs, but there are no dorsal spines on this or succeeding somites. A1 extends to posterior border of urosomite 2. P5 basal segment short and broad, terminal spine stout, curved and smooth. Male: 0.91–1.30 mm. Posterior prosomal borders rounded and with teeth as in the female. Urosomite 1 with lateral hairs, somites 2, 3, and 4 with a posterior row of minute denticles. Caudal rami short and broad with inner hairs. A1 extends almost to posterior border of prosome. Right P5 Re1 with a process on posterior side bearing a slender seta, Re2 produced into a large inner lobe; left Re2+3 with a stout terminal spine and a curved anterior seta (very similar to *A. bifilosa*, see Gurney) (Gurney, 1927).

13. *A. italica* Steuer, 1910b. Female: 0.70–1.00 mm. Posterior prosome borders rounded, and generally without spines. Urosome naked. B2 of P5 almost twice as long as wide, carrying a fine outer seta and a curved spine, thickened at its base and serrate along its distal half. Male: 0.70–1.00 mm. Posterior prosome with some dorsal spines, and some fine ventral hairs. Urosome naked. Right B2 of P5 with a proximal bent tooth on inner surface, Re1 inner border concave, without an internal spine, Re2 with a large inner edge appendix bearing a spine, Re3 with a characteristic irregular outline ending in a short apical spine; left P5 with a moderately large apical spine on Re2+3, and dorsally there is a rounded, hairy tooth (Steuer, 1910b).

14. *A. tonsa* Dana, 1849. Female: 1.30–1.50 mm. Posterior prosome rounded, with some small spinules on posterior border. Urosome short, naked except anal somite which has hairs on its borders (Mediterranean and Black Sea specimens were much more "hairy" but variable in this respect (Belmonte *et al.*, 1994)), genital double-somite with broadest part of somite anterior in dorsal view. B2 of P5 longer than wide, with a broad

projection on inner distal corner, terminal spine is bulbous at its base, coarsely denticulate near end, and is longer than external plumose seta. A1 not spinous. Male: 1.00–1.10 mm. Urosomites 1 and 2 decorated with dorsolateral spinules, somites 1–4 with posterodorsal spines. Right P5 with Re1 slender, without an internal spine, Re2 with a broadly based inner expansion; left Re2+3 with a terminal slender spine and subterminal spine which is expanded for most of its length, except tip, and is covered with numerous small hairs, the expanded spine originates from an area of Re2+3 which is fringed with long bristles (Giesbrecht, 1892; Remy, 1927; Belmonte *et al.*, 1994).

Subgenus *Acartia*

Rostral filaments present. Ovaries fused. Posterior prosomal borders rounded or drawn out into a point. Female P5 B1 with long plumose seta, terminal spine denticulate. Right male leg 5 Re1 with a distal appendage. Indopacific and Atlantic species. Oceanic in all tropical and subtropical seas (Steuer, 1915, 1923).

15. *A. danae* Giesbrecht, 1889. Female: 1.08–1.27 mm. Posterior prosome terminates in symmetrical points. Urosome without spines, but with fine dorsal hairs on posterior border of first two somites, genital double-somite longer than following somite. A1 extends as far as posterior border of caudal rami; its first segment with a strong, heavy spine. P5 B2 longer than wide; terminal spine twice as long as its segment, denticulate at end; plumose seta 3 times longer than spine. Male: 0.73–0.80 mm. Posterior prosome as in female. Urosomite 1 with lateral hairs. Right P5 with a pointed projection on internal border of B2; left Re2+3 with 4 short spines (Giesbrecht, 1892; Steuer, 1923).

16. *A. negligens* Dana, 1849. Female: 1.04–1.27 mm. Posterior prosome border rounded with 1 or many small spines and a range of more dorsal fine hairs. Urosome with spinules; first two somites with dorsal spinules on posterior border. A1 reaches end of the body, its first segment has a small, slender spine. B2 of P5 longer than wide, inner spine dentate and less than twice length of its segment, external plumose seta very long, at least 5 times longer than spine. Male: 0.80–1.00 mm. A1 shorter than body. Urosomites 1 and 2 hairy on both sides; other somites with dorsoposterior spinules. P5 similar to *A. danae*, but without internal appendix on the right B2 (Giesbrecht, 1892; Steuer, 1923).

Subgenus *Hypoacartia*

Rostral filaments present. Ovaries paired. Female posterior prosomal borders with asymmetrical lateral extensions. Female leg 5 inner border with a broad, dentate terminal spine. Male leg 5 superficially similar to that of *A. discaudata*. Coastal species (Steuer, 1915).

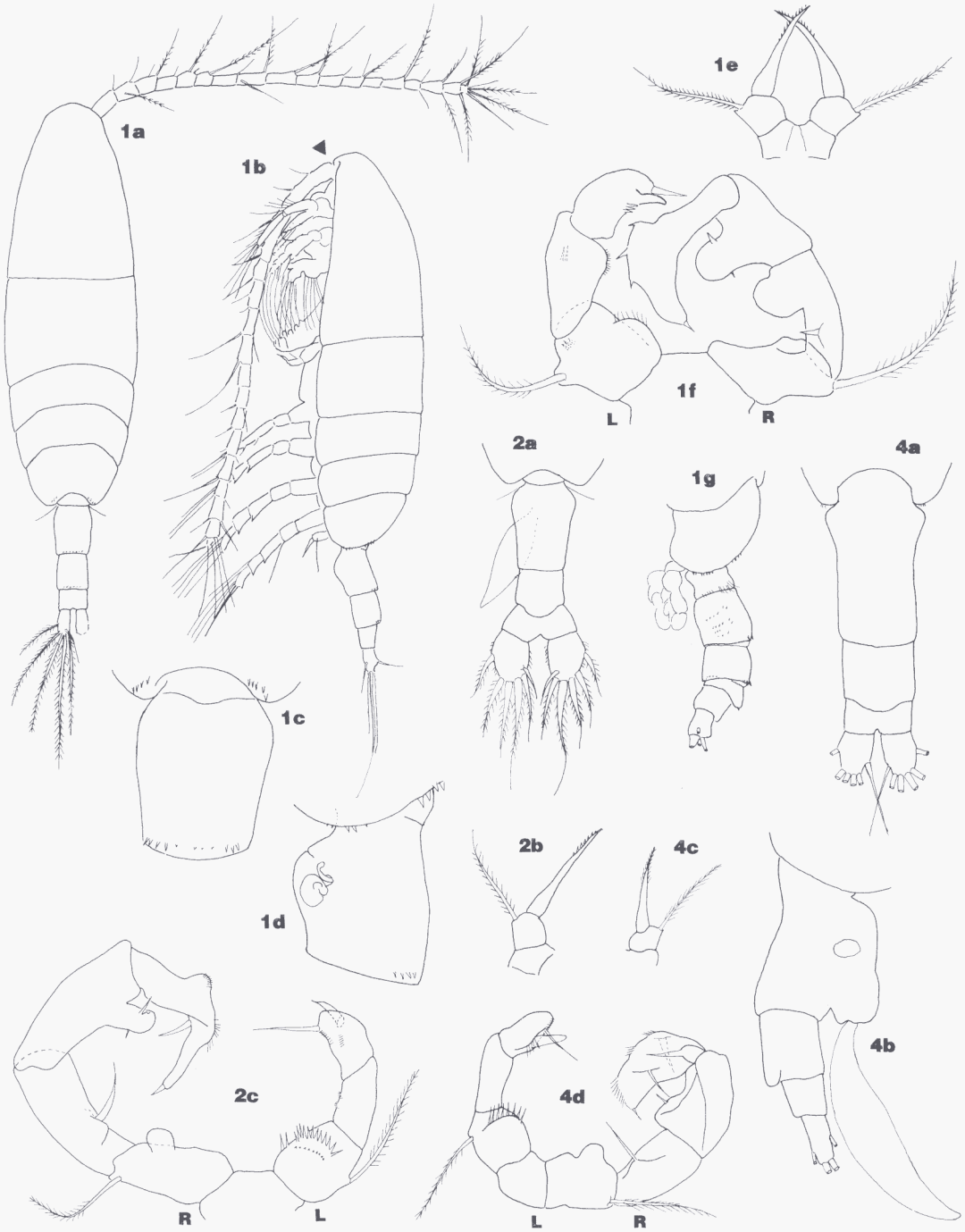
17. *A. adriatica* Steuer, 1910. Female: 1.05–1.22 mm. Posterior prosome with 2 lateral unequal points, point on left is stronger and longer. Genital double-somite asymmetrical. One caudal seta a little stronger than others. P5 with an external plumose seta much longer than terminal spine, which is bent to outside and is thickened and toothed on inner border basally and distally. Male: 1.18–1.27 mm. Posterior prosome with a curved line of spinules. P5 is strong; left B2 swollen; Re1 short and carrying 2 distinctive elements in the form of a claw; 1 element (Re2+3) is subrectangular and terminated by a hook which is toothed on its outer border and has a large triangular tooth on its inner border, and 1 element in the form of a simple, slender claw, as long as other element, and inserted in a prominent "pincushion"; right Re3 is strong and hook-like, and the internal projection on Re2 is very long, straight, finger-like, and forms a pincer with Re2 projection (Steuer, 1910b; Brian, 1927).

18. *A. macropus* Cleve, 1900. Female: 1.18 mm. Last two somites of prosome with two small, asymmetrical finger-like processes, left one straight and placed more posteriorly than right curved process. Genital double-somite is 3 times as long as urosomite 2, which is equal to urosomite 3. Longest seta on caudal rami exceeds urosome in length; all setae of equal thickness. Caudal rami nearly twice as long as broad. Prosome 3 times longer than broad. P5 terminal spine very short and apparently fused with B2; its interior margin is denticulate. Male: 1.23 mm. Lateral corners of prosome rounded; margin of last somite smooth, without small spines. Right Re2 of P5 longer than broad, inner projection arises from proximal half of segment, Re3 elongate with a very small terminal claw (Cleve, 1900).

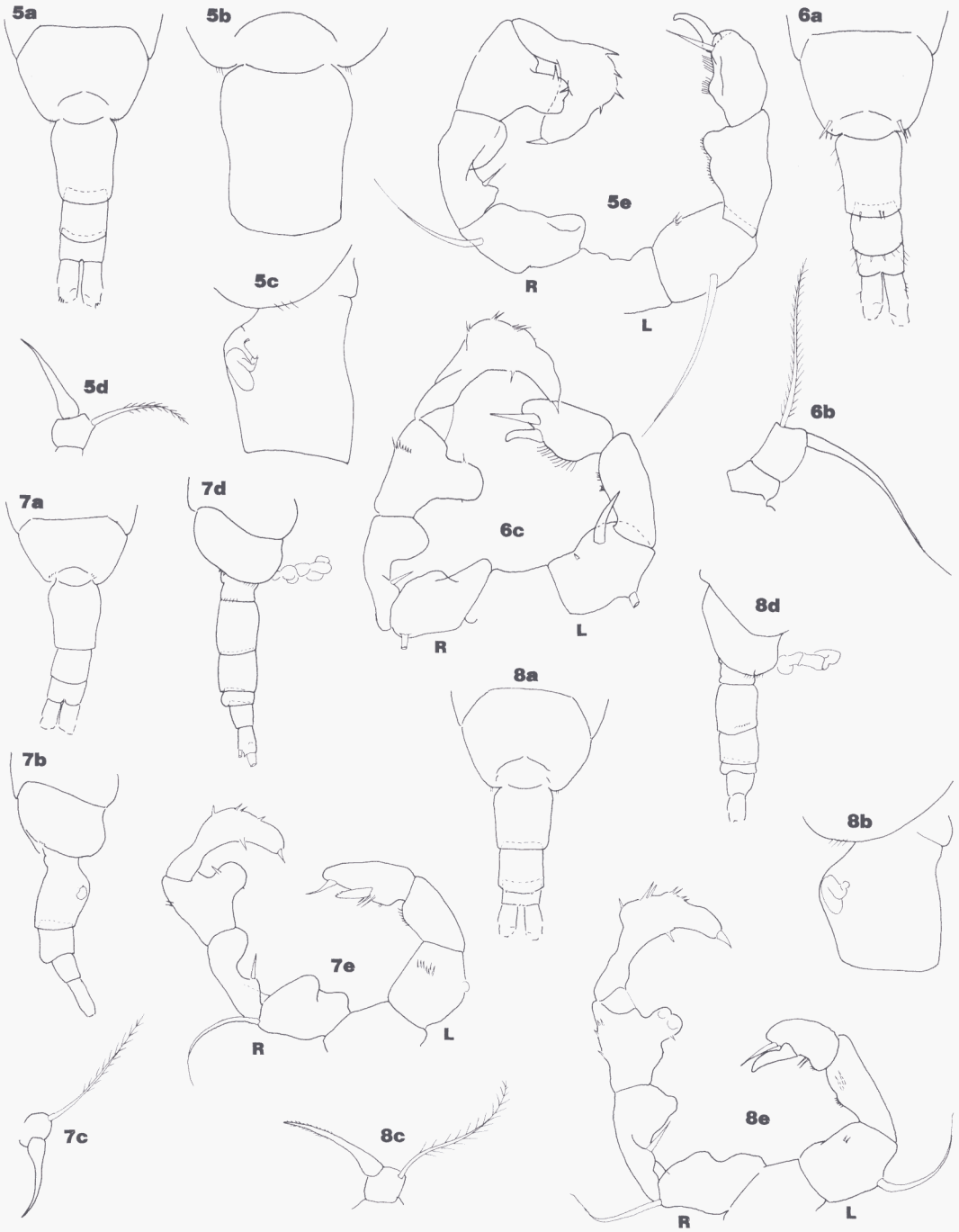
Key to the species of *Acartia*

Females

1.	Rostral filaments absent (Fig. 1b)	2
	Rostral filaments present (Fig. 14a)	9
2.	Anal somite much wider than urosomite 2 in dorsal view (Fig. 2a)	*A. discaudata*
	Anal segment not wider than urosomite 2 in dorsal view (Fig. 1a)	3



Figures 1–4. 1. *Acartia clausii*. a: Female dorsal view; b: female lateral view; c: female genital double-somite, dorsal view; d: female genital double-somite, lateral view; e: female P5; f: male P5; g: male urosome, lateral view. 2. *A. discaudata*. a: Female urosome, dorsal view; b: female P5; c: male P5. 3. *A. discaudata* var. *mediterranea* figures not included here. 4. *A. enzoi*. a: Female urosome, dorsal view; b: female urosome, lateral view; c: female P5; d: male 5.



Figures 5–8. 5. *Acartia hudsonica*. a: Female urosome, dorsal view; b: female genital double-somite, dorsal view; c: female genital double-somite, lateral view; d: female P5; e: male P5. 6. *A. longiremis*. a: Female urosome, dorsal view; b: female P5; c: male P5. 7. *A. margalefi*. a: Female urosome, dorsal view; b: female urosome, lateral view; c: female P5; d: male urosome, lateral view; e: male P5. 8. *A. omorii*. a: Female urosome, dorsal view; b: female genital double-somite, lateral view; c: female P5; d: male urosome, lateral view; e: male P5.

3. Genital double-somite in lateral view with a large, ventral prominence posterior to genital apertures (Fig. 4b); in dorsal view genital double-somite twice length of urosomite 2, and with an anterior angular swelling (Fig. 4a) *A. enzoi*

   Genital double-somite in lateral view with a smoothly curving ventral surface (Fig. 5c) 4

4. Anal somite spinous; posterior prosome with 1 very large spine and several small spines, genital double-somite and urosomite 2 with surface spinules as well as posterior spines (Fig. 6a) *A. longiremis*

   Anal somite naked or with very fine spinules (Fig. 5a) 5

5. Genital swelling placed anteriorly on somite in lateral view (Figs. 5c, 7b) 6

   Genital swelling approximately central on somite in lateral view (Figs. 1b, 8b, 9b) 7

6. Prosome naked posterodorsally but with posterior hairs (Figs. 5b, c); length of right caudal ramus less than twice width (1.69–1.91) *A. hudsonica*

   Prosome with posterodorsal spines (Figs. 7a, b); length of right caudal ramus more than twice width (2.12–2.43) *A. margalefi*

7. Posterior prosome naked or with ventral hairs (Figs. 8b, 9b) 8

   Posterior prosome bearing spines (Fig. 1c); P5 terminal spine thick, length of right caudal ramus usually less than twice its width *A. clausii*

8. Large species (total length 0.94–1.05 mm) with urosomite 2 naked or with 1–3 posterodorsal blunt teeth (Fig. 8a). Right caudal ramus length:width 1.50–1.82 *A. omorii*

   Small species (total length 0.71–0.87 mm) with naked urosomites (Fig. 9a). Right caudal ramus length:width 1.71–2.20 *A. teclae*

9. The external plumose seta of P5 clearly shorter than terminal spine, B2 twice as long as wide (Fig. 13c) *A. italica*

   The external plumose seta of P5 more or less equal in length to terminal spine (Figs. 10b, 14c) 10

   The external plumose seta of P5 longer or much longer than terminal spine (Figs. 12b, 15b, 16b, 17b, 18b) 11

10. Urosome covered in very fine spinules (Fig. 10a). Spine on P5 finely haired at its tip and almost straight (Fig. 10b) *A. bifilosa*

    Urosome naked (Fig. 11a). Spine on P5 bulbous basally, finely haired at its tip which is bent (Fig. 11b) *A. bifilosa* var. *inermis*

    Urosomites 1 and 2 with posterodorsal spinules (Fig. 14b). Spine on P5 denticulate at its tip and straight, B2 with an internal projection (Fig. 14c) *A. tonsa*

11. Spine on P5 bent to outside, long, its internal border grossly toothed (Fig. 17b) *A. adriatica*

    Spine on P5 bent to outside, thick, short, its internal border coarsely toothed (Figs. 18a–c) *A. macropus*

    Spine on P5 not bent, finely or moderately toothed on both borders (Figs. 12b, 15b, 16b). 12

12. External plumose seta on P5 less than 1.5 times as long as its spine (Fig. 12b) *A. fossae*

    External plumose seta on P5 3 times as long as its spine (Fig. 15b) *A. danae*

    External plumose seta on P5 5 times as long as its spine (Fig. 16b) *A. negligens*

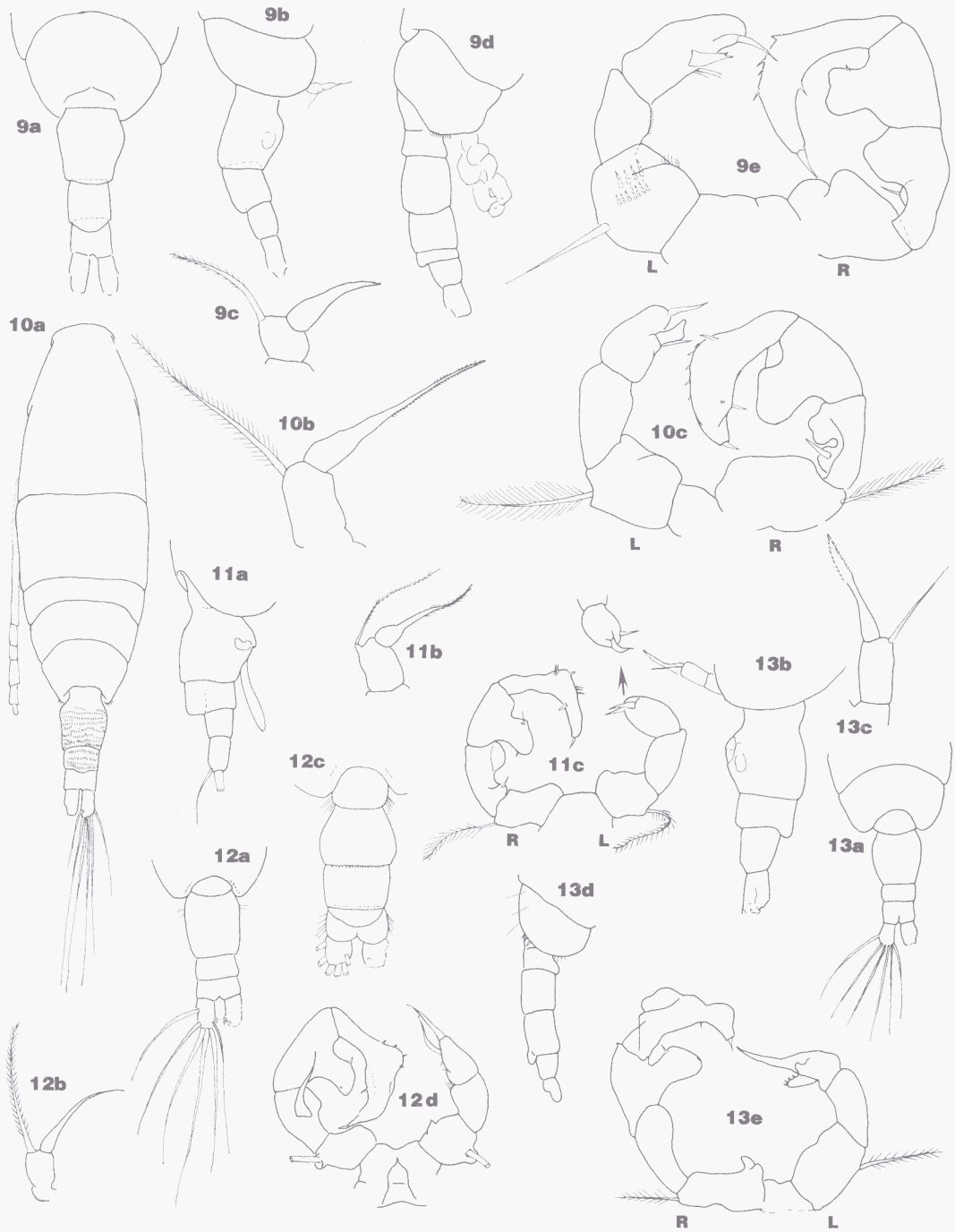
Males

1. Rostral filaments absent (Fig. 1b) 2

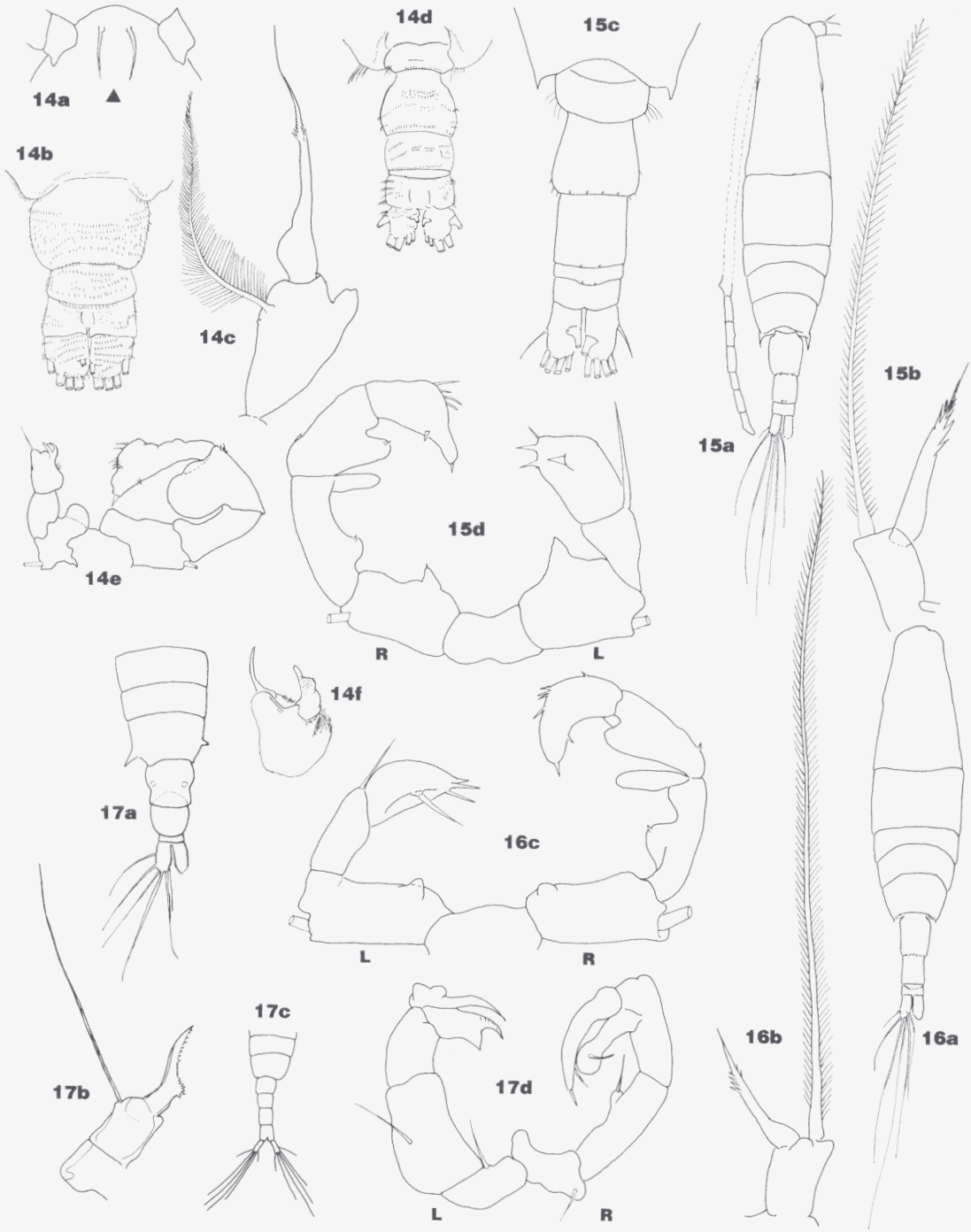
   Rostral filaments present (Fig. 14a) 8

2. Right P5 Re1 not expanded at inner distal border, left B2 with two long rows of spines, one composed of very large spines, the other of very small spines (Fig. 2c) *A. discaudata*

   Right P5 Re1 not expanded at inner distal border, left B2 with one long row of very long spines (Fig. 4d) *A. enzoi*



Figures 9–13. 9. *Acartia teclae*. a: Female urosome, dorsal view; b: female urosome, lateral view; c: female P5; d: male urosome, lateral view; e: male P5. 10. *A. bifilosa*. a: Female dorsal view; b: female P5; c: male P5. 11. *A. bifilosa* var. *inermis*. a: Female urosome, lateral view; b: female P5; c: male P5. 12. *A. fossae*. a: Female urosome, dorsal view; b: female P5; c: male urosome, dorsal view; d: male P5. 13. *A. italica*. a: Female urosome, dorsal view; b: female urosome, lateral view; c: female P5; d: male urosome, lateral view; e: male P5.



Figures 14–17. 14. *Acartia tonsa*. a: female rostral filaments, ventral view; b: female urosome, dorsal view; c: female P5; d: male urosome, dorsal view; e: male P5; f: male P5 left Re2+3. 15. *A. danae*. a: Female dorsal view; b: female P5; c: male urosome, dorsal view; d: male P5. 16. *A. negligens*. a: Female dorsal view; b: female P5; c: male P5. 17. *A. adriatica*. a: Female dorsal view; b: female P5; c: male urosome, dorsal view; d: male P5.

Right P5 Re1 expanded at inner distal border, left B2 otherwise decorated (e.g., Fig. 6c) 3

3. Left P5 B2 with 2 types of spines or spinules on posterior surface, one type very large (Fig. 6c) *A. longiremis*

Left P5 B2 with spinules of uniformly small size on posterior surface (e.g., Figs. 7e, 9e) 4

4. Left P5 Re2+3 longer than or equal to Re1 (Figs. 7e, 9e) 5

Left P5 Re2+3 shorter than Re1 (e.g., Fig. 1e) 6

5. Posterior prosome border with posterodorsal spinules and posterior hairs (Fig. 7d). P5 right Re2 inner lobe rounded terminally (Fig. 7e) *A. margalefi*

Posterior prosome border with posteroventral hairs (Fig. 9d). P5 right Re2 inner lobe angular because of 2 terminal processes giving it a slightly bilobed appearance (Fig. 9e) *A. teclae*

6. Posterior prosome with posterodorsal spines and posterior stiff hairs (Fig. 1g) *A. clausii*

Posterior prosome with posteroventral hairs (e.g., Fig. 8d) 7

7. Left P5 Re2+3 with long equal spines more than half length of segment, anterior heavy spine inserted proximal to posterior spine; right Re2 with outer edge spines (Fig. 8e) *A. omorii*

Left P5 Re2+3 with long equal spines about half length of segment, each inserted at same level distally on segment; right Re2 outer edge naked (Fig. 5e) *A. hudsonica*

8. Posterior prosome corners rounded, often bearing small spines or hairs (e.g., Figs. 12c, 17c) 9

Posterior prosome corners extend into points (Fig. 15c). Left P5 terminated by 4 spines, B2 of left and right P5 with an internal pointed extension, right Re1 with a long, thin, inner, distal appendix (Fig. 15d) *A. danae*

9. Left P5 Re2+3 in form of a pincer with a heavy outer spine. Inner appendix on right. Re2 narrow and elongate (Figs. 17d, 18f) 10

Left P5 Re2+3 not in form of a pincer. Right Re2 with a wide, short appendix or without any appendix (e.g., Figs. 10c, 16c) 11

10. Right P5 Re2 inner appendix placed on very distal part of segment. Re3 not much longer than Re2 appendix. Right B2 with proximal inner expansion (Fig. 17d) *A. adriatica*

Right P5 Re2 inner appendix arises from middle to proximal part of segment. Re3 more than twice as long as Re2 appendix. Right B2 without prominent inner expansion (Fig. 18f) *A. macropus*

11. Right P5 Re2 without conspicuous inner expansion. Left Re1 with, along outer distal spine, Re2+3 with 3 terminal spines and 1 longer spine inserted at about midlength on inner border (Fig. 16c) *A. negligens*

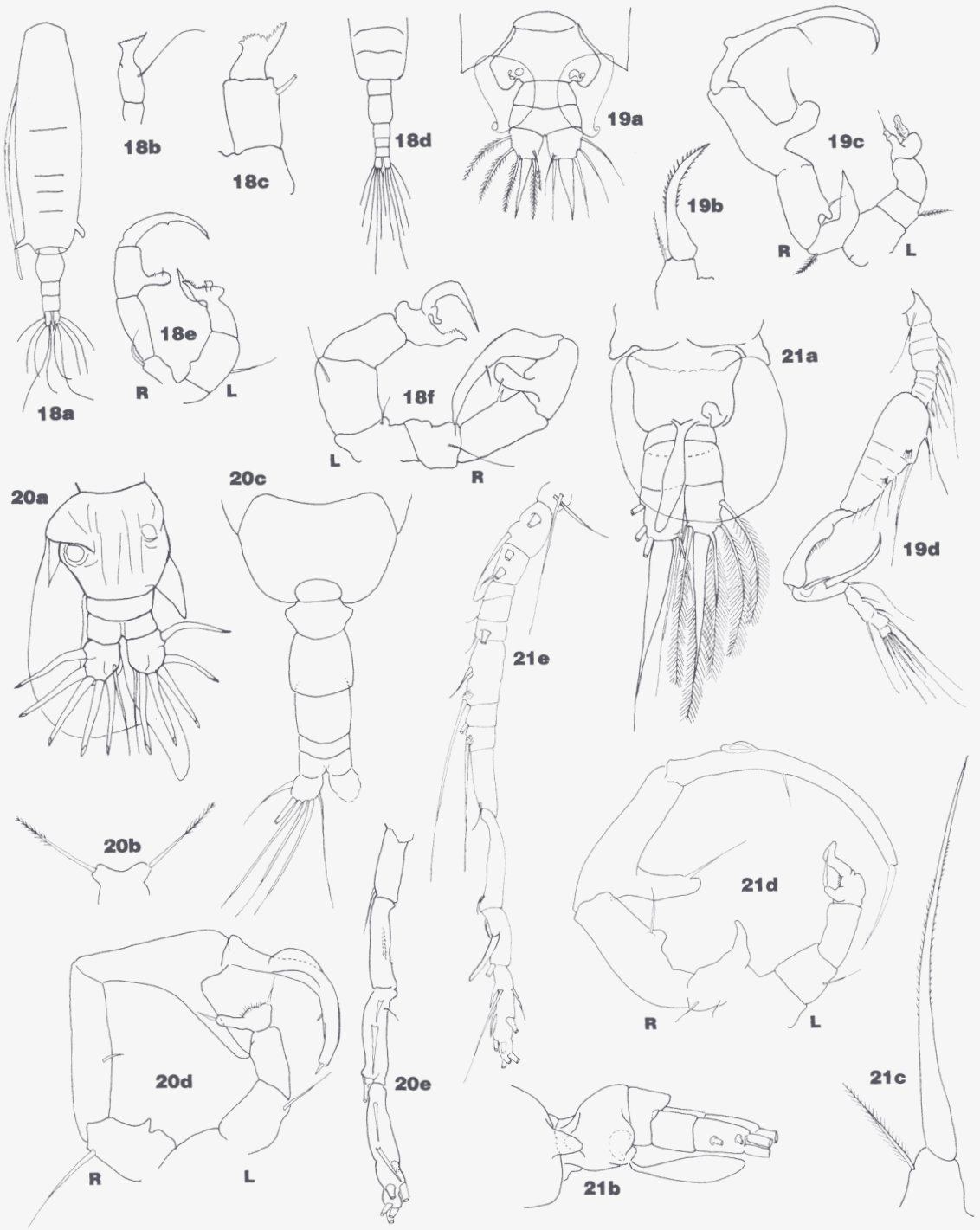
Right P5 Re2 with a conspicuous inner expansion. Left Re1 outer distal border naked, Re2+3 with 1 terminal spine and at least 1 other spine (e.g., Figs. 10c, 12d, 13e) 12

12. Right P5 Re1 with a moderately sized, broadly rounded distal expansion (Fig. 10c) *A. bifilosa*

Right P5 Re1 without a distal expansion, or small expansion and a long posterior surface spine (e.g., Figs. 12d, 13e, 14e) 13

13. Right P5 Re1 with a long posterior surface spine which arises midway along its segment and extends half way along Re2; Re2 with width of base of inner expansion less than half length of segment. Left B2 with a small inner triangular knob (Fig. 12d) *A. fossae*

Right P5 Re1 without a long spine on posterior surface. Re2 with width of base of inner expansion less than half length of segment. Left B2 without inner tooth. Right B2 with small proximal triangular tooth (Fig. 13e) *A. italica*



Figures 18–21. 18. *Acartia macropus*. a: Female dorsal view; b, c: female P5; d: male urosome, dorsal view; e, f: male P5. 19. *Paracartia grani*. a: female urosome, dorsal view; b: female P5; c: male P5; d: male right A1. 20. *P. latisetosa*. a: Female urosome, ventral view; b: female urosome, lateral view; c: female P5; d: male P5; e: male right A1. 21. *Pteriacartia josephinae*. a: Female urosome, dorsal view; b: female P5; c: male urosome, dorsal view; d: male P5; e: male terminal part of right A1.

Right P5 Re1 without a long spine on posterior surface. Re2 with width of base of inner expansion approximately equal to length of segment. Left B2 with a broadly rounded inner expansion. Right B2 with a large proximal broadly rounded expansion (Fig. 14e) *A. tonsa*

Genus *Paracartia* Scott, T., 1894

Rostral filaments present. Sexual dimorphism strongly marked. Ovaries paired. Last prosomite of female usually strongly spread into wing-shaped extensions on each side, that of male simple with lateral parts not expanded. Urosome of female comparatively short, of 3 free somites with genital double-somite expanded laterally, may be asymmetrical, genital pores laterally placed on somite; caudal rami broad and one of apical setae may or may not be transformed into a thickish spine. Urosome of male slender, of 5 somites, with caudal rami of normal shape. Female A1 as in *Acartia*; right geniculate A1 of male may be expanded. A2, mouth parts, and swimming legs similar to those of *Acartia*. Female leg 5 with both basis fused, terminal spine, if present, is heavily built, and lateral seta is usually much shorter than terminal spine. Male leg 5 is powerfully developed; right leg much larger and terminates in a very long slender incurved claw, B2 with a conspicuous inner projection which is sometimes very large; left Re2+3 usually wider than long, bearing at least two spines which oppose each other to make segment resemble a chela. The spermatophore, fixed to genital double-somite of female, is accompanied by a complicated thin plate which may curve around female genital double-somite (Sars, 1904).

19. *P. grani* Sars, 1904. Female: 1.0 mm (prosome 0.93–1.29 mm). Posterior prosomal corners enlarged in form of wings. Urosome naked, short with genital double-somite strongly enlarged and with obviously asymmetrical caudal rami (broadest on left) which have an extraordinarily thickened seta on each side. A1 nearly as long as prosome and not carrying denticles. P5 B2 may be fused together, with a fine, short, plumose seta and a strong, curved terminal claw which is a little larger on right side than on left. Spermatophore narrow, bottle-shaped, accompanying plate is curved upwards on both sides. Male: 1.0 mm (prosome 0.77–1.03 mm). Posterior prosome rounded. Urosome slender, naked; caudal rami comparatively small and symmetrical, marginal setae normally developed. Right A1 powerfully built with proximal part of middle section swollen, first segment of terminal section armed with a long claw-like spine curving anteriorly. P5 B1 fused, right B2 fused to B1 and carrying a pointed, finger-like appendix, right P5 almost 3 times as long as left leg, Re2 carrying a rounded appendix on proximal inner border, Re3 in form of a very long, thin hook; left P5 without internal appendices; Re2+3 with a terminal finger-like lobe and a subterminal tapering, fluted projection (Sars, 1904).

20. *P. latisetosa* (Krichagin, 1873). Female: 0.82–1.23 mm. Posterior prosomal corners prolonged into rounded, asymmetrical points, strongest on left. Urosome short. Genital double-somite asymmetrical, uneven. Caudal rami short, asymmetrical, stronger on right. Third seta (counted from inner edge) on caudal rami thickened and asymmetrical, plumose only at tip. P5 basis with a very small external plumose seta; terminal spine is very long, slender and pointed, plumose at its end. Male: 0.81–1.20 mm. Right geniculate A1 without a specially widened section. P5 very asymmetrical; much stronger on right where it is terminated by a long spine, right Re2 with a long proximal inner appendix (Giesbrecht, 1892).

Key to the species of *Paracartia*

Females

1. Genital double-somite symmetrical with widest part, in dorsal view, posterior to middle of somite (Fig. 19a). P5 with a heavy terminal spine and very small external plumose setae (Fig. 19b) *P. grani*

   Genital double-somite symmetrical with widest part, in dorsal view, anterior (Fig. 21a). P5 with a long terminal spine and very small external plumose setae (Fig. 21c) *P. latisetosa*

Males

1. Right A1 with middle segments swollen, outer middle spine on segments 19–21 very large extending almost to end of A1 (Fig. 19d). Right P5 B1 with long triangular appendix, Re2 with proximal rounded appendix less than 1/3 length Re3 (Fig. 19c) *P. grani*

   Right A1 with middle segments not swollen, outer middle spine on segments 19–21 moderately large extending to point of fusion of segments 22 and 23 (Fig. 21e). Right P5 B1 with a long triangular appendix, Re2 with proximal rounded appendix less than 1/3 length Re3 (Fig. 21d) *P. latisetosa*

Genus *Pteriacartia* Belmonte, 1998b

Rostral filaments present. Sexual dimorphism marked. Last prosomite of female and male rounded. Urosome of female comparatively short, of 3 free somites with genital double-somite asymmetrical, longer than half the urosome, genital pores paired, laterally placed, without opercula; fin-like expansion on right side of genital double-somite. Male urosome slender, of 5 free somites, caudal rami short. Female A1 of 22 segments. Right geniculate A1 of male without swollen segments. Female leg 5 reduced to small knob, each with 1 long seta. Male leg 5 right leg much larger than left leg and terminates in a long claw which is curved inwards, Re2 of right leg with a long finger-like protrusion originating from the distal half of the segment; left leg Re2+3 half-moon-shaped with spines at either end. The spermatophore is fixed by a gelatinous 'apron' to the ventral surface of female genital double-somite (Belmonte, 1998b).

21. *P. josephinae* (Crisafi, 1974). Female: 0.81–1.00 mm. Posterior prosome rounded. Genital double-somite carrying a tapering, posterolateral appendix on right which extends almost to posterior border of anal somite; genital apertures laterally placed. Attached spermatophore appears to be accompanied by an asymmetrical oval lamella which is spread out beneath urosome and extends to right and to just beyond caudal rami. No setae on caudal rami obviously enlarged. Pedigerous somites 1 and 2 appear to be fused. P5 is minute and slender compared with all other swimming legs, each leg bearing only a plumose seta. Male: 0.79–0.87 mm. Right geniculate A1 without a specially widened section. Right P5 B2 with two, small inner swellings, distalmost of which is triangular in shape, Re2 with a long, thin, distal appendix, Re3 with a centrally placed outer keel; left Re2+3 with an inner rounded appendix terminated by a pointed spine, outer corner terminated in a similar spine, between these two corners is a raised, hairy area (Crisafi, 1974).

References to descriptions and figures

1. *A. clausii*: SARS, 1903; BRADFORD, 1976; ALCARAZ, 1976.
2. *A. discaudata*: SARS, 1903; BRADFORD, 1976.
3. *A. discaudata* var. *mediterranea*: STEUER, 1929.
4. *A. enzoi*: CRISAFI, 1974.
5. *A. hudsonica*: BRADFORD, 1976; UEDA, 1986.
6. *A. longiremis*: SARS, 1903; BRADFORD, 1976.
7. *A. margalefi*: ALCARAZ, 1976; BRADFORD, 1976.
8. *A. omorii*: BRADFORD, 1976; UEDA, 1986b.
9. *A. teclae*: BRADFORD, 1976.
10. *A. bifilosa*: GIESBRECHT, 1892.
11. *A. bifilosa* var. *inermis* ROSE, 1929.
12. *A. fossae*: GURNEY, 1927.
13. *A. italica*: STEUER, 1910.
14. *A. tonsa*: GIESBRECHT, 1892; REMY, 1927.
15. *A. danae*: GIESBRECHT, 1892.
16. *A. negligens*: GIESBRECHT, 1892.
17. *A. adriatica*: STEUER, 1910b; BRIAN, 1927.
18. *A. macropus*: CLEVE, 1900.
19. *Paracartia grani*: SARS, 1904.
20. *Paracartia latisetosa*: GIESBRECHT, 1892.
21. *Pteriacartia josephinae*: CRISAFI, 1974; BELMONTE 1998b.

Distribution

1. *A. clausii*: Mediterranean and eastern Atlantic
2. *A. discaudata*: British, Scandinavian, and French (Dunkirk) waters
3. *A. discaudata* var. *mediterranea*: western Mediterranean, English Channel
4. *A. enzoi*: southeastern Italian estuarine waters
5. *A. hudsonica*: Japan and North American waters
6. *A. longiremis*: northern waters of North America and Europe
7. *A. margalefi*: Atlantic coastal waters of Spain, France, all Italian seas, English Channel, Norway, Black Sea
8. A. *omorii*: Japan
9. *A. teclae*: Mediterranean and Norwegian waters
10. *A. bifilosa*: North Sea, Scandinavian, French (Dunkirk) waters
11. *A. bifilosa* var. *inermis*: estuary of the Loire River, in the Atlantic near Gibraltar, British coastal waters
12. *A. fossae*: Suez Canal, Lebanon
13. *A. italica*: Southern Adriatic, Black Sea, Aegean Sea, northern Ionian Sea
14. *A. tonsa*: both coasts of North and South America, Mediterranean, Black Sea, European coastal waters from the Gulf of Finland to the Bay of Biscay, and British coastal waters
15. *A. danae*: tropical and subtropical waters of all oceans
16. *A. negligens*: tropical and subtropical waters of all oceans
17. *A. adriatica*: northern Adriatic Sea, Aegean Sea, northern Ionian Sea
18. *A. macropus*: Azores
19. *Paracartia grani*: coast of Norway, Mediterranean coasts of Spain and Lebanon
20. *P. latisetosa*: Mediterranean, Black Sea, Mauritanian coast
21. *Pteriacartia josephinae*: southeastern Italian estuarine waters, southern Adriatic and northern Ionian Seas, southern Mediterranean

Selected references to work in biology and distribution of the species

–Alcaraz (1976): 7. (1983): 1, 2, 7, 19. –Apostolopoulou (1973): 1, 6, 16. –Ayukai (1987): 1?, (1988): 8. –Bellantoni and Peterson (1987): 14. –Belmonte *et al.* (1989): 7, 13, 20, 21. –Belmonte (1992): 21, (1997): 13, 17, (1988a): 1, 7, 13, 14, 17, 20, 21. –Belmonte *et al.* (1994): 14. –Belmonte and Puce (1994): 21. –Berggreen *et al.* (1988): 14. –Belmonte and Mazzocchi (1997): 7. –Bollens and Frost (1990): 5, (1991): 5. –Bradford (1976): 8, 9. –Brylinski (1981): 14. –Cleve (1900): 18. –Cowles *et al.* (1988): 14. –Calbert and Alcaraz (1996): 19. –Castro-Longoria and Williams (1996): 7. –Crisafi (1974): 4, 21. –Durbin and Durbin (1992a): 5, (1992b): 5. –Durbin *et al.* (1990): 14, (1992): 5. –Farran (1948): 1, 2, 6, 10, 14, 15, 19. –Fonda–Umani and Cocchietto (1988): 1. –Gaedke (1990): 14. –Gaudy and Pagano (1987): 14. –Giesbrecht, (1892): 1, 2, 6, 10, 14, 15. –Gifford and Dagg (1988): 14. –Gurney, (1927): 12, 20. –Hay *et al.* (1988): 1. –Hirakawa (1988): 8. –Houde and Roman (1987): 14. –Ianora and Buttino (1990): 1. –Irigoien and Castel (1995): 10. –Ishii (1990): 8. –Ives (1987): 5. –Jonsson and Tiselius (1990): 14. –Kimoto (1988): 8. –Kleppel (1992): 14. –Kleppel *et al.* (1988): 14. –Kostrichkina *et al.* (1992): 10. –Kuosa (1989): 10. –Le Fèvre–Lehoërff (1971): 1, 2, 19. –Marcus (1990): 1?, 14. –Meneghetti *et al.* (1991): 7. –Næss (1991): 9. –Noji *et al.* (1991): 1. –Norrbin *et al.* (1990): 6. –Paffenhöfer and Stearns (1988): 14. –Peterson *et al.* (1991): 6. –Razouls and Durand (1991): 1, 2, 3, 4, 6, 7, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21. –Rémy (1927): 14. –Roche–Mayzaud (1991): 1. –Roche–Mayzaud and Mayzaud (1987): 1. –Rodriguez *et al.* (1985): 1, 2, 19. –Rodriguez and Jimenez (1990): 19. –Rose (1929): 11. –Sabatini (1990): 14. –Saiz and Alcaraz (1991): 19, (1992): 1. –Sars (1903): 1, 2, 6. –Sobral (1985): 1, 14. –Stearns *et al.* (1989): 14. –Steuer (1910a): 1, 17, 20. (1910b): 13. (1923): 1, 2, 6, 10, 13, 14, 15, 16, 17, 18?, 19, 20. (1929): 1, 3, 6, 13, 15, 16, 17, 20 –Stoecker and Egloff (1987): 14. –Støttrup and Jensen (1990): 14. –Sullivan and Banzon (1990): 5. –Tanaka *et al.* (1987a): 8, (1987b): 8. –Taylor (1987): 1, 2, 6, 11, 14. –Tiselius (1989): 1. –Tiselius and Jonsson (1990): 1. –Uchima and Hirano (1986): 8. –Ueda (1986a): 5, (1986b): 5, 8. –Uye and Takamatsu (1990): 8. –Viitasalo (1992): 10. –Viitasalo and Katajïsto (1994): 10. –Vives (1978): 1, 15, 16. –White and Dagg (1989): 14. –Wiadnyana and Razzoul-zadegan (1989): 1. –Wlodarczyk *et al.* (1992): 5. Yen and Fields (1992): 5. –Yoo *et al.* (1991): 5, 8, 10, 15, 16. –Zagami and Guglielmo (1991): 7.

Origin of Figures

Figs. 10a–c; 15a, b; 16a, b; 20b–e after Giesbrecht (1892); Figs. 17a, b, d, e after Cleve (1900); Figs. 1a, b, e; 2a, b; 6b after Sars (1903); Figs. 19a–d after Sars (1904); Figs. 13a–e; Figs. 15c, d; 16c after Steuer (1923); Figs. 17a–d after Brian (1927); Figs. 12a–d after Gurney (1927); Figs. 14a, c, e after Rémy (1927); Figs. 11a–c after Rose (1929); Figs. 4a–d; 21b after Crisafi (1974); Figs. 1c, d, f; 2c; 5a–e; 6a, c; 7a–e; 8a–e; 9a–e after Bradford (1976); Figs. 14b, d, f drawn from SEM photos provided by Dr Genuario Belmonte (Università degli Studi de Lecce, Italy); Figs. 17a, c, f after original of Dr Miguel Alcaraz (Instituto de Ciencias del Mar, Barcelona, Spain); Figs. 21c, e original from specimens from Port Cesarea provided by Dr Belmonte; Fig. 21a original provided by Dr Belmonte; Fig. 20a original drawing from a south Adriatic Sea male provided by Dr Belmonte.

References

Alcaraz, M. 1976. Description of *Acartia margalefi*, a new species of pelagic copepod, and its relationship with *A. clausi*. Inv. Pesq., 40(1): 59–74.

Alcaraz, M. 1983. Coexistence and segregation of congeneric pelagic copepods: spatial distribution of the *Acartia* complex in the *ria* of Vigo (NW Spain). J. Plankt. Res., 5(6): 891–900.

Apostolopoulou, M. 1972. Occurrence and fluctuation of the pelagic copepods of the Aegean Sea with some notes on their ecology. Hellenic Oceanol. Limnol., 11: 325–402.

Ayukai, T. 1987. Feeding by the planktonic calanoid copepod *Acartia clausi* Giesbrecht on natural suspended particulate matter of varying quantity and quality. J. exp. mar. Biol. Ecol., 106(2): 137–149.

Ayukai, T. 1988. Egg production by the planktonic calanoid copepod *Acartia omorii* in Onagawa Harbor during spring–summer. Bull. Plankt. Soc. Japan, 35(2): 127–132.

Barthélémy, R-M., Cuoc, C., Defaye, D., Brunet, M., and Mazza, J. 1998. Female genital structures in several families of Centropagoidea (Copepoda: Calanoida). Phil. Trans. R. Soc. Lond. B, 353: 721–736.

Bellantoni, D. C., and Peterson, W. T. 1987. Temporal variability in egg production rates of *Acartia tonsa* Dana in Long Island Sound. J. exp. mar. Biol. Ecol., 107(3): 199–208.

Belmonte, G. 1992. Diapause egg production in *Acartia* (*Paracartia*) *latisetosa* (Crustacea, Copepoda, Calanoida). Boll. Zool., 59: 363–366.

Belmonte, G. 1997. Resting eggs in the life cycle of *Acartia italica* and *A. adriatica* (Copepoda, Calanoida, Acartiidae). Crustaceana, 70(1): 114–117.

Belmonte, G. 1988a. The egg morphology of seven Acartiidae species: a preliminary survey of the ootoxonomy of calanoids. J. Mar. Sys., 15: 1–4.

Belmonte, G. 1998b. *Pteriacartia*, a new genus of Acartiidae (Calanoida, Diaptomoidea) for *Acartia josephinae* Crisafi, 1974. J. Mar. Sys., 15: 359–368.

Belmonte, G., Benassi, G., and Ferrari, I. 1989. L'associazione di quattro specie di *Acartia* nel Lago di Acquatina (Basso Adriatico). Oebalia, N.S., 15(1): 519–522.

Belmonte, G., and Mazzocchi, M. G. 1997. Records of *Acartia (Acartiura) margalefi* (Copepoda, Calanoida, Acartiidae) from the Norwegian and Black Seas. Crustaceana, 70: 252.

Belmonte, G., Mazzocchi, M. G., Prusova, I. Yu, and Shadrin, N. V. (1994). *Acartia tonsa*, a species new for the Black Sea fauna. Hydrobiologia, 292/293: 9–15.

Belmonte, G., and Puce, M. (1994). Morphological aspects of subitaneous and resting eggs of *Acartia josephinae* (Calanoida). Hydrobiologia, 292/293: 131–135.

Berggreen, U., Hansen, B., and Kioerboe, T. 1988. Food size spectra, ingestion and growth of the copepod *Acartia tonsa* during development: implications for determination of copepod production. Mar. Biol., 99(3): 341–352.

Bollens, S. M., and Frost, B. W. 1990. UV light and vertical distribution of the marine planktonic copepod *Acartia hudsonica* Pinhey. J. exp. mar. Biol. Ecol., 137(2): 89–93.

Bollens, S. M., and Frost, B. W. 1991. Diel vertical migration in zooplankton: rapid individual response to predators. J. Plankt. Res., 13(6): 1359–1365.

Bradford, J. M. 1976. Partial revision of *Acartia* subgenus *Acartiura* (Copepoda: Calanoida: Acartiidae). N. Z. Jl mar. Freshwat. Res., 10: 159–202.

Brian, A. 1927. Descrizione de maschio di *Hypoacartia adriatica* Steuer, copepodo pelagico rivenuto in abbondanza nell'Egeo. Boll. Musei Lab. Zool. Anat. comp. R. Univ. Genova, Ser. 2, Vol 7(12): 1–4.

Brylinski, J. M. 1981. Report on the presence of *Acartia tonsa* Dana (Copepoda) in the harbour of Dunkirk (France) and its geographical distribution in Europe. J. Plankt. Res., 3(2): 255–260.

Brylinski, J. M. 1984. Anomalies morphologiques chez le genre *Acartia* (Crustacea, Copepoda): description et essai de quantification. J. Plankt. Res., 6(6): 961–965.

Calbet, A., and Alcaraz, M. 1996. Effects of constant and fluctuating food supply on egg production rates of *Acartia grani* (Copepoda: Calanoida). Mar. Ecol. Prog. Ser., 140: 33–39.

Castro-Longoria, E., and Williams, J. A. 1996. First report of the presence of *Acartia magalefi* (Copepoda: Calanoida) in Southampton Water and Horsea Lake, UK. J. Plankt. Res., 18: 567–575.

Cleve, P. T. 1900. Notes on some Atlantic plankton organisms. K. svenska VetensAkad. Handl., 34(1): 1–22, pls 1–8.

Cowles, T. J., Olson, R. J., and Chisholm, S. W. 1988. Food selection by copepods: discrimination on the basis of food quality. Mar. Biol., 100(1): 41–49.

Crisafi, P. 1974. Inquinamento e speciazione: *Acartia josephinae* e *A. enzoi* (Copepoda, Calanoida), specie nuove del mare Mediterraneo. Boll. Pesca Piscic. Idrobiol., 29(1): 5–10.

Dana, J. D. 1846. Notice of some genera of Cyclopacea. Ann. Mag. nat. Hist., 18: 181–185.

Dana, J. D. 1847, 1849. Conspectus crustaceorum, in orbis terrarum circumnavigatione, Caroli Wilkes, e classe Reipublicae foederatae duce, collectorum auctore. Proc. Am. Acad. Arts Sci., 1: 149–155 (1847); 2: 9–61 (1849).

Durbin, E. G., and Durbin, A. G. 1992a. Effects of temperature and food abundance on grazing and short-term weight change in the marine copepod *Acartia hudsonica*. Limnol. Oceanogr., 37(2): 361–378.

Durbin, E. G., and Durbin, A. G. 1992b. Seasonal changes in size frequency distribution and estimated age in the marine copepod *Acartia hudsonica* during a winter–spring diatom bloom in Narragansett Bay. Limnol. Oceanogr., 37(2): 379–392.

Durbin, E. G., Durbin, A. G., and Campbell, R. G. 1992. Body size and egg production in the marine copepod *Acartia hudsonica* during a winter–spring diatom bloom in Narragansett Bay. Limnol. Oceanogr., 37(2): 342–360.

Durbin, A. G., Durbin, E.G., and Wlodarczyk, E. 1990. Diel feeding behavior in the marine copepod *Acartia tonsa* in relation to food availability. Mar. Ecol. Prog. Ser., 68 (102): 23–45.

Farran, G. P. 1948. Copepoda, Sub-order: Calanoida, Family: Acartiidae, Genus: *Acartia*. Fich. Ident. Zooplancton, 12: 1–4.

Fonda-Umani, S., and Cocchietto, M. 1988. Filtration and ingestion rate of *Acartia clausi* in the Gulf of Trieste. Associazione Italiana di Oceanologia e Limnologia, Trieste (Italy), 8: 383–395. Congr. dell' Associazione Italiana di Oceanologia e Limnologia, Pallanza (Italy), 1–3 June 1988. Ed. by D. Bregant and G. P. Fanzutti.

Gaedke, U. 1990. Population dynamics of the calanoid copepods *Eurytemora affinis* and *Acartia tonsa* in the Ems–Dollart Estuary: a numerical simulation. Arch. Hydrobiol., 118(2): 185–226.

Gaudy, R., and Pagano, M. 1987. Copepod nutrition in a Mediterranean lagoon in terms of particle concentration and temperature. 2. Coll. Franco-Sovietique, Yalta (USSR), 27 Oct to 2 Nov 1984, Second Soviet French Symposium on Production and Trophic Relationships within Marine Ecosystems, 5: 137–151.

Giesbrecht, W. 1881. Vorläufige Mitteilung aus einer Arbeit über die freilebenden Copepoden des Keiler Hafens. Zool. Anz., 4(83): 254–258.

Giesbrecht, W. 1889. Elenco dei Copepodi pelagici raccolti dal Tenente di vascello Gaetano Chierchia durante il viaggio della R. Corvetta "Vettor Pisani" negli anni 1882–1885 e dal Tenente di vascello Francesco Orsini nel Mar Rosso, nel 1884. Atti Accad. naz. Lincei Rd., Cl. Sci. fis. mat. nat., (4)5 sem. 1: 811–815; sem. 2: 24–49.

Giesbrecht, W. 1892. Systematik und Faunistik der pelagischen Copepoden des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. Fauna Flora Golfo Neapel, 19: 1–831, pls 1–54.

Gifford, D. J., and Dagg, M. J. 1988. Feeding of the estuarine copepod *Acartia tonsa* Dana: carnivory vs. herbivory in natural microplankton assemblages. Zooplankton Behavior Symposium, Savannah, GA (USA), 13–16 Apr 1987. Ed. by G. A. Paffenhöfer and H. J. Price. Bull. mar. Sci., 43(3): 458–468.

Gurney, R. 1927. Report on the Crustacea: Copepoda and Cladocera of the plankton. Trans. Zool. Soc. Lond., 22: 139–177.

Hay, S. J., Evans, G.T., and Gamble, J. C. 1988. Birth, growth and death rates for enclosed populations of calanoid copepods. J. Plankt. Res., 10(3): 431–454.

Hirakawa, K. 1988. New records of the North Pacific coastal planktonic copepods, *Acartia omorii* (Acartiidae) and *Oithona davisae* (Oithonidae) from southern Chile. Bull. mar. Sci. 42: 337–339.

Houde, S. E. L., and Roman, M. R. 1987. Effects of food quality on the functional ingestion response of the copepod *Acartia tonsa*. Mar. Ecol. Prog. Ser., 40(1–2): 69–77.

Huys, R., and Boxshall, G. A. 1991. Copepod evolution. The Ray Society, London. 468 pp.

Ianora, A., and Buttino, I. 1990. Seasonal cycles in population abundances and egg production rates in the planktonic copepods *Centropages typicus* and *Acartia clausi*. J. Plankt. Res., 12(3): 473–481.

Irigoien, X., and Castel, J. 1995. Feeding rates and productivity of the copepod *Acartia bifilosa* in a highly turbid estuary; the Gironde (SW France). Hydrobiologia, 311(1–3): 115–125.

Ishii, H. 1990. In situ feeding rhythms of herbivorous copepods, and the effect of starvation. Mar. Biol., 105(1): 91–98.

Ives, J. D. 1987. Possible mechanisms underlying copepod grazing responses to levels of toxicity in red tide dinoflagellates. J. exp. mar. Biol. Ecol., 112(2): 131–145.

Jonsson, P. R., and Tiselius, P. 1990. Feeding behaviour, prey detection and capture efficiency of the copepod *Acartia tonsa* feeding on planktonic ciliates. Mar. Ecol. Prog. Ser., 60(1–2): 35–44.

Kimoto, K. 1988. Segregation of vertical distribution of calanoid copepod *Acartia omorii* depending on the developmental stages in Shijiki Bay, western Kyushu, Japan. Bull. Seikai Natl Fish. Res. Inst., 66: 35–39.

Kleppel, G. S. 1992. Environmental regulation of feeding and egg production by *Acartia tonsa* off southern California. Mar. Biol., 112(1): 57–65.

Kleppel, G. S., Pieper, R. E., and Trager, G. 1988. Variability in the gut contents of individual *Acartia tonsa* from waters off Southern California. Mar. Biol., 92(2): 185–190.

Kostrichkina, E. M., Line, R. Ya., Berzin'sh, V., Modre, B. A., and Mazmach, M. B. 1992. On prediction of zooplankton abundance in the Riga Gulf at the species level. Gidrobiol. Zh., 28(3): 25–31.

Kovalev, A. V., and Schmelva, A. A. 1982. Fauna veslonogikh rachkov (Copepoda) Sredismenogo morya. Ekol. Moraya, 8: 82–87 (in Russian).

Krichagin, N. 1873. Materialy dlya fauny sostochnogo berega Chernago Morya. In: Otchet o faunisticheskikh' isslodovaniya, proizvedennykh' letom' 1872 goda, po porucheniyu Kievskago obshchestva estestvois'pytatelei na vostochnykh beregakh Chernogo morya. Zap. kiev. Obshch. Estest, 3(3): 370–429, pls 10–14 (Ukrainian).

Kuosa, H. 1989. Effect of oxygen concentration on the activity and survival of a copepod, *Acartia bifilosa* (Giesbr.). Aquacult. Fenn., 19(1): 47–50.

Le Fèvre-Lehoërff, G. 1971. Etude d'un cycle nycthemeral dans l'estuaire de la riviere de Morlaix Hydrologie et zooplancton. Rev. Trav. Inst. Pêches marit., 35(3): 347–366.

Lilljeborg, W. 1853. De crustaceis ex ordinibus tribus: Cladocera, Ostracoda et Copepoda in Scania occurrentibus. Lund. 222 pp.

Lindley, J. A. 1990. Distribution of overwintering calanoid copepod eggs in sea-bed sediments around southern Britain. Mar. Biol., 104: 209–217.

McKinnon, A. D., Kimmerer, W. J., and Benzie, J. A. H. 1992. Sympatric sibling species within the genus *Acartia* (Copepoda: Calanoida): a case study from Westernport and Port Phillip Bays, Australia. J. Crust. Biol., 12(2): 239–259.

Marcus, N. H. 1990. Calanoid copepod, cladoceran, and rotifer eggs in sea-bottom sediments of northern Californian coastal waters: identification, occurrence and hatching. Mar. Biol., 105: 413–418.

Meneghetti, F., Bisol, P. M., Cervelli, M., Comaschi Scaramuzza, A., and Battaglia, B. 1991. Polimofismi enzimatici in copepodi dei genere *Acartia* della laguna di Venezia. Atti Accad. naz. Lincei Cl. Sci. Fis. Mat. Nat. Rend., 2(1): 87–96.

Næss, T. 1991. Marine calanoid resting eggs in Norway: abundance and distribution of two copepod species in the sediment of an enclosed marine basin. Mar. Biol., 110: 261–266.

Noji, T. T., Estep, K. W., MacIntyre, F., and Norrbin, F. 1991. Image analysis of faecal material grazed upon by three species of copepods: evidence for coprorhexy, coprophagy and coprochaly. J. mar. biol. Ass. U.K., 71(2): 465–480.

Norrbin, M. F., Olsen, R. E., and Tande, K. S. 1990. Seasonal variation in lipid class and fatty acid composition of two small copepods in Balsfjorden, northern Norway. Mar. Biol., 105(2): 205–211.

Paffenhöfer, G. A., and Stearns, D. E. 1988. Why is *Acartia tonsa* (Copepoda: Calanoida) restricted to nearshore environments? Mar. Ecol. Prog. Ser., 42: 33–38.

Peterson, W. T., Tiselius, P., and Kioerboe, T. 1991. Copepod egg production, moulting and growth rates, and secondary production, in the Skagerrak in August 1988. J. Plankt. Res., 13(1): 131–154.

Pinhey, K. F. 1926. Entomostraca of the Belle Isle Strait Expedition, 1923, with notes on other planktonic species. Contr. Can. Biol. Fish., n. ser. 3(6): 181–233, figs. 1–8, tabs. 1–56.

Razouls, C., and Durand, J. 1991. Survey of Mediterranean planktonic copepods. Vie Milieu, 41(1): 73–77.

Rémy, P. 1927. Note sur un Copépode de l'eau saumâtre du canal de Caen à la mer (*Acartia* (*Acanthacartia*) *tonsa* Dana). Annls biol. lacustre, 15: 169–186.

Roche-Mayzaud, O., and Mayzaud, P. 1987. Purification of endo- and exolaminarinase and partial characterization of the exo-acting form from the copepod *Acartia clausi* (Giesbrecht, 1889). Comp. Biochem. Physiol., 88B(1): 105–110.

Roche-Mayzaud, O., Mayzaud, P., and Biggs, D. C. 1991. Medium-term acclimation of feeding and of digestive and metabolic enzyme activity in the neritic copepod *Acartia clausi*. 1. Evidence from laboratory experiments. Mar. Ecol. Prog. Ser., 69(1–2): 25–40.

Rodriguez, V., and Jimenez, F. 1990. Co-existence within a group of congeneric species of *Acartia* (Copepoda Calanoida): sexual dimorphism and ecological niche in *Acartia grani*. J. Plankt. Res., 12(3): 491–511.

Rodriguez, V., Rodriguez, J., and Niell, F. X. 1985. Coexistencia de especies congenéricas de *Acartia* (Copepoda) en sistemas alterados: una aproximación empleando la teoria del nicho. Inv. Pesq. 49(1): 15–34.

Rose, M. 1929. Copépodes pélagiques particulièrement de surface provenant des campagnes scientifiques du Prince Albert Ier de Monaco. Résult. Camp. scient. Prince Albert I, 78: 1–123, pls 1–6.

Sabatini, M. E. 1990. The developmental stages (Copepodids I to VI) of *Acartia tonsa* Dana, 1849 (Copepoda, Calanoida). Crustaceana 59 (1): 53–61.

Saiz, E., and Alcaraz, M. 1991. Effects of small-scale turbulence on development time and growth of *Acartia grani* (Copepoda: Calanoida). J. Plankt. Res., 13(4): 873–883.

Saiz, E., and Alcaraz, M. 1992. Free-swimming behaviour of *Acartia clausi* (Copepoda: Calanoida) under turbulent water movement. Mar. Ecol. Prog. Ser., 80(2–3): 229–236.

Sars, G. O. 1903. Copepoda Calanoida. An account of the crustacea of Norway, with short descriptions and figures of all the species. 4: i–xiii, 145–171, pls 97–102, suppl. pls 1–6.

Sars, G. O. 1904. Description of *Paracartia grani*, G. O. Sars, a peculiar calanoid occurring in some of the oyster-beds of western Norway. Bergens Mus. Aarb., 4: 1–16, 6 pls.

Scott, T. 1894. Report on the Entomostraca from the Gulf of Guinea, collected by John Rattrey, B.Sc. Trans. Linn. Soc. Lond. Zool., Ser. 2, 6: 1–161, pls 1–15.

Sewell, R. B. S. 1949. The littoral and semiparasitic Cyclopodia, the Monstrilloida and Notodelphyoida. Sci. Rep. John Murray Exp. 9(2): 17–199.

Sobral, P. 1985. Distribuição de *Acartia tonsa* Dana no Estuário do Tejo e sua relação com *Acartia clausi* Giesbrecht. Bol. Inst. nac. Invest. Pescas (Lisboa.), 13: 61–75.

Stearns, D. E., Tester, P. A., and Walker, R. L. 1989. Diel changes in the egg production rate of *Acartia tonsa* (Copepoda, Calanoida) and related environmental factors in two estuaries. Mar. Ecol. Prog. Ser., 52(1): 7–16.

Steuer, A. 1910a. Adriatische Planktoncopepoden. Sber. Akad. Wiss. Wien, mat.-nat. Kl., 119, Abt. 1: 1005–1039, figs. 1–6.

Steuer, A. 1910b. Plankton-Copepoden aus dem Hafen von Brindisi. Sber. Akad. Wiss. Wien, mat.-nat. Kl., 119, Abt. 1: 591–598, figs. 1–6.

Steuer, A. 1915. Revision der Gattung *Acartia* Dana. Zool. Anz., 45: 392–397.

Steuer, A. 1923. Bausteine zu einer Monographie der Copepodengattung *Acartia*. Arb. zool. Inst. Univ. Innsbruck, 1(5): 91–144 (sep.: 156), figs. 1–179, pls. 1–5, maps 1–6.

Steuer, A. 1929. Die Arten der Copepodengattung *Acartia* in der mediterranen Provinz. Sber. Akad. Wiss. Wien, mat.-nat. Kl., 138, Abt. 1: 497–516, figs. 1–5.

Stoecker, D. K., and Egloff, D. A. 1987. Predation by *Acartia tonsa* Dana on planktonic ciliates and rotifers. J. exp. mar. Biol. Ecol., 110(1): 53–68.

Støttrup, J. G., and Jensen, J. 1990. Influence of algal diet on feeding and egg-production of the calanoid copepod *Acartia tonsa* Dana. J. exp. mar. Biol. Ecol., 141(2–3): 87–105.
Sullivan, B. K., and Banzon, P. V. 1990. Food limitation and benthic regulation of populations of the copepod *Acartia hudsonica* Pinhey in nutrient-limited and nutrient-enriched systems. Limnol. Oceanogr., 35(7): 1618–1631.
Tanaka, M., Ueda, H., and Azeta, M. 1987a. Near-bottom copepod aggregations around the nursery ground of the juvenile red sea bream in Shijiki Bay. Bull. Jap. Soc. sci. Fish., 53(9): 1537–1544.
Tanaka, M., Ueda, H., Azeta, M., and Sudo, H. 1987b. Significance of near-bottom copepod aggregations as food resources for the juvenile red sea bream in Shijiki Bay. Bull. Jap. Soc. sci. Fish., 53(9): 1545–1552.
Taylor, C. J. L. 1987. The zooplankton of the Forth, Scotland. Proc. Roy. Soc. Edinb., 93B: 377–388.
Tiselius, P. 1989. Contribution of aloricate ciliates to the diet of *Acartia clausi* and *Centropages hamatus* in coastal waters. Mar. Ecol. Prog. Ser., 56(1–2): 49–56.
Tiselius, P., and Jonsson, P. R. 1990. Foraging behaviour of six calanoid copepods: observations and hydrodynamic analysis. Mar. Ecol. Prog. Ser., 66(1–2): 23–33.
Ucnima, M., and Hirano, R. 1986. Predation and cannibalism in neritic copepods. Bull. Plankt. Soc. Japan, 33(2): 147–149.
Ueda, H. 1986a. Redescription of the planktonic calanoid copepod *Acartia hudsonica* from Atlantic and Pacific waters: a new record from Japanese waters. J. oceanogr. Soc. Jap., 42(2): 124–133.
Ueda, H. 1986b. Taxonomic reexamination and geographic distribution of copepods known as *Acartia clausi* in Japanese coastal and inlet waters. J. oceanogr. Soc. Jap., 42(2): 134–138.
Uye, S. 1983. Seasonal cycle in abundance of resting eggs of *Acartia steueri* Smirnov (Copepoda: Calanoida) in sea-bottom mud of Onagawa Bay, Japan. Crustaceana, 44: 103–105.
Uye, S. 1985. Resting egg production as a life history strategy of marine planktonic copepods. Bull. mar. Sci., 37(2): 440–449.
Uye, S., and Takamatsu, K. 1990. Feeding interactions between planktonic copepods and red-tide flagellates from Japanese coastal waters. Mar. Ecol. Prog. Ser., 59(1–2): 97–107.
Viitasalo, M. 1992. Mesozooplankton of the Gulf of Finland and northern Baltic proper – a review of monitoring data. Ophelia, 35(2): 147–168.
Viitasalo, M., and Katajisto, T. 1994. Mesozooplankton resting eggs in the Baltic Sea: identification and vertical distribution in laminated and mixed sediments. Mar. Biol., 120: 455–465.
Vives, F. 1978. Distribución de la población de copépodos en el Mediterráneo occidental. Res. Exp. cient., 7: 263–302.
White, J. R., and Dagg, M. J. 1989. Effects of suspended sediments on egg production of the calanoid copepod *Acartia tonsa*. Mar. Biol., 102(3): 315–319.
Wiadnyana, N. N., and Rassoulzadegan, F. 1989. Selective feeding of *Acartia clausi* and *Centropages typicus* on microzooplankton. Mar. Ecol. Prog. Ser., 53(1): 37–45.
Wlodarczyk, E., Durbin, A. G., and Durbin, E. G. 1992. Effect of temperature on lower feeding thresholds, gut evacuation rate, and diel feeding behavior in the copepod *Acartia hudsonica*. Mar. Ecol. Prog. Ser., 85(1–2): 93–106.
Yen, J., and Fields, D. M. 1992. Escape responses of *Acartia hudsonica* (Copepoda) nauplii from the flow field of *Temora longicornis* (Copepoda). *In* Advanced techniques for in situ studies of zooplankton abundance, distribution and behaviour. Ed. by W. G. Sprules, P. C. Schulze, C. E. Williamson. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, 36: 123–134.
Yoo, K. I., Hue, H. K., and Lee, W. C. 1991. Taxonomical revision on the genus *Acartia* (Copepoda: Calanoida) in the Korean waters. Bull. Korean Fish. Soc., 24(4): 255–265.
Zagami, G., and Guglielmo, L. 1991. Ritrovamento di *Acartia margalefi* (Alcaraz, 1976) (Copepoda, Calanoida) in una baia antistante le saline di Trapani – Paceco (Sicilia occ.) e nei laghi de Ganzirri e Faro (Messina, Sicilia or.) Mem. biol. mar. oceanogr., 17(1): 61–64.