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A systematic revision of the genus *Dynamene* (CRUSTACEA: ISOPODA) with descriptions of three new species

by

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12 Figures and 2 Tables

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Summary. The synonomy of the genus *Dynamene* is reviewed and clarified, the use of *Naesa* and *Nesaea* being invalidated. A revised generic diagnosis is given, and all species incorrectly attributed to the genus are listed. Three existing species are validated and redescribed, and three new species namely, *D. torelliae*, *D. tubicauda*, and *D. magnitorata* are described for the first time. A seventh known species *D. bifida* may be synonymous with *D. ramuscula* from Australia.

INTRODUCTION

Taxonomic literature relating to the British intertidal sphaeromid isopod *Dynamene bidentata* (ADAMS) is confused, notably since the young stages and sexually dimorphic adults were originally ascribed to different genera. In addition, the common Mediterranean species has been wrongly ascribed to the species *D. bidentata*. The present study aims to clarify generic terminology, to redescribe the type species and to compare it with other known species. Three new species, two found at Naples and one from Roscoff are described for the first time.

GENERIC NAME

The proper designation of this genus has been in doubt for many years (see for example MARINE BIOLOGICAL ASSOCIATION 1906, 1957; OMER-COOPER and RAWSON, 1934; BRUCE, COLMAN and JONES, 1963). ADAMS (1800) first described the male as *Oniscus bidentatus*, the female being unknown at that time. The generic name *Nesaea*, monotypical for *O. bidentatus*, was introduced by LEACH (in BREWSTER, 1814), and in the same publication females were allotted to a new genus, *Dynamene*, which was introduced, with diagnosis, but without including any nominal species. LEACH (1818) later changed *Nesaea* to *Naesa*, giving no reason. The change may have been made to correct a possible printing error

in the original name, since LEACH (1815) writes « *Naesa* », not « *Nesaea* », when quoting his original reference to *Nesaea* in BREWSTER (1814). Alternatively, the name may have been changed because *Nesaea* was already occupied as the generic name for three species of coralline algae described by ELLIS and SOLANDER (1786) (see LAMOUROUX, 1812).

LEACH (1815) repeated the diagnosis for *Dynamene*, again without including any nominal species, but later (LEACH, 1818) described immature stages, and colour varieties of the female, as *D. montagui*, *D. rubra*, and *D. viridis* (see for example BATE and WESTWOOD, 1868).

Eventually recognition that the genera *Naesa* and *Dynamene* represented the males and females of the same genus (BATE and WESTWOOD, 1868; HESSE, 1873) led to them being united under the name *Dynamene* (HOLMES, 1904; STEBBING, 1905 b). Since then several authors have used the name *Naesa*, no doubt because a form of this name was originally used for the male, and because arguments given for the use of *Dynamene* were inadequate.

For the following two reasons the generic name *Dynamene* is considered here to have priority. First, strictly speaking the generic name *Dynamene* is preceeded only by the name *Nesaea* and this must be regarded as a taxon removed from the Animal Kingdom (Article 2 b, INTERNATIONAL RULES OF NOMENCLATURE, 1964) having been used by LAMOUROUX (1812) for coralline algae. *Nesaea* Leach must therefore, be a junior hononym. The use of *Nesaea* LEACH (1814), or *Dynamene* LEACH (1814) would normally depend on the action of the first revisor (Article 24a) since they were names published for the same taxon in the same work, but as *Nesaea* is to be considered a junior hononym then *Dynamene* must take precedence.

Second, *Naesa* LEACH (1815), seems to have been regarded as an emendation of *Nesaea* to avoid homonomy but as LEACH did not state this specifically then it must be regarded as a misspelling with no status in nomenclature (Article 32c).

GENERIC DIAGNOSIS

Body roughly oval, moderately convex with highest point on peraeonal somites 3 and 4 in females and 6 in males. Males usually narrower and more convex. Marked sexual dimorphism in adults. Dorsal surface and lateral margins of the pleura often hirsute, amount varying with species.

Head narrower than body and produced anteriorly into a narrow epistome which joins the labrum ventrally (Fig. 1 A), front produced into a rim in one species; eyes round or kidney-shaped.

Peraeon with somites approximately equal in length in females but with sixth largest in adult males; pleura extending postero-laterally beyond the

level of the succeeding somite. Sixth somite of male produced into two pairs of backwardly directed processes, one pair small and arising from the tergo-pleural suture, the other large, mid-dorsal, and varying in shape according to species (Fig. 2 A); the larger bidentate process is characteristic of the genus. Seventh

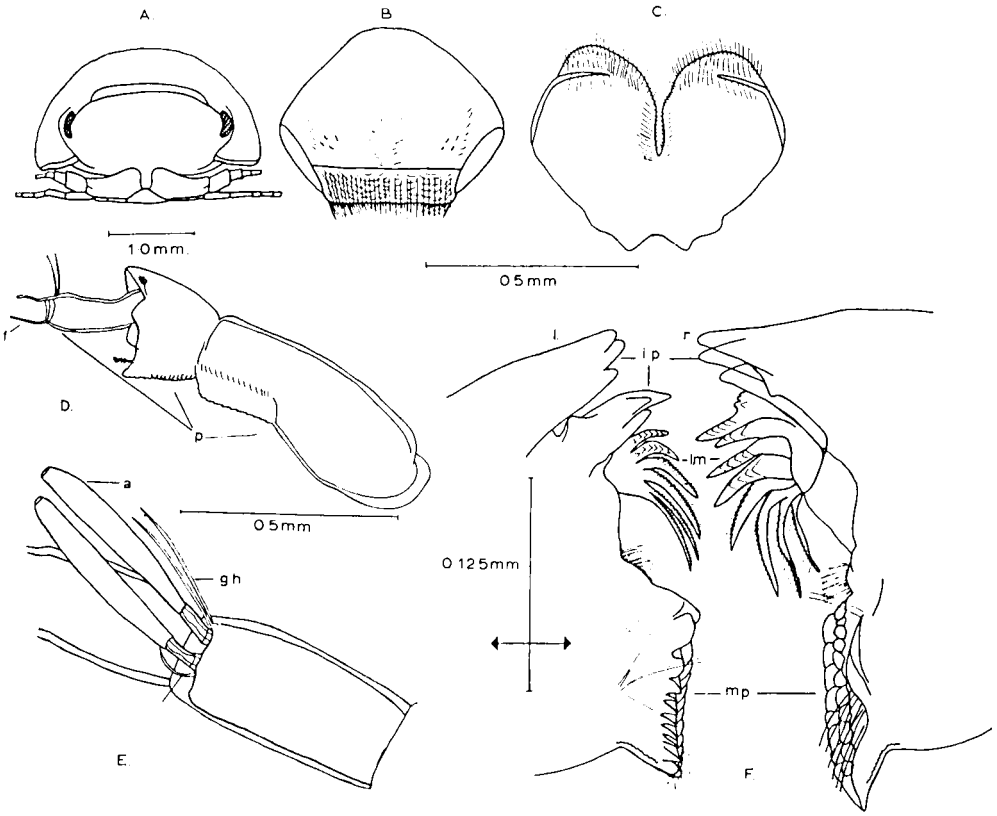

FIG. 1. *Head and some appendages of the type species* D. bidentata. A. *Head from front showing insertion of the antennules and antennae and the articulation of the narrow epistome with the labrum.* B. *Labrum.* C. *Paragnaths.* D. *Antennular peduncle.* E. *Pair of aesthetascs on the 4th proximal antennular article.* F. *Mandibles of male.* f., *flagellum;* p., *peduncle;* a., *aesthetasc;* g.h., *guard hairs;* l., *left;* r., *right;* i.p., *incisor process;* l.m., *lacinia mobilis;* m.p., *molar process.*

somite overlapped by sixth in males, pleura extended postero-laterally into two small processes in males, varying in shape according to species (Fig. 2 B).

Pleon consisting of an unsegmented tergum of similar width to the peraeonal somites, incompletely divided laterally by two sutures, small bosses occasionally present on pleura in male.

Pleotelson composed of medial dome-shaped tergum surrounded by a laterally expanded shelf, the two sides of which meet posteriorly enclosing a deep channel leading to the respiratory chamber beneath the dome. Pleotelsonic

dome smooth in females often with median keel; rugose in males, with a posterior median tubercle or pair of tubercles varying in shape according to species (Fig. 2 C). Pleotelsonic shelf occasionally rugose; uropods inserted late-

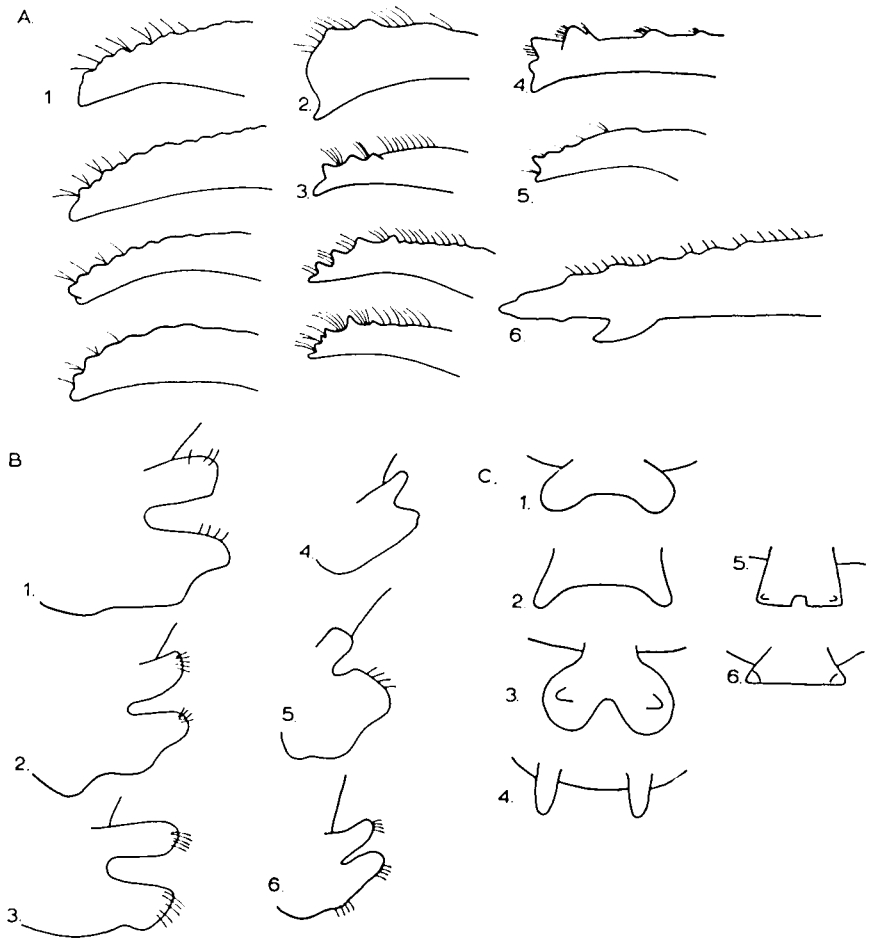

FIG. 2. A. *Single arm (lateral view) of bidentate pocesses of:* 1. D. bidentata *(4 varieties)*. 2. D. edwardsi. 3. D. torelliae *(3 varieties)*. 4. D. magnitorata. 5. D. tubicauda. 6. D. bifida. - B. *Left seventh peraeonal pleura (lateral view) of:* 1. D. bifida. 2. D. edwardsi. 3. D. magnitorata. 4. D. tubicauda. 5. D. bidentata. 6. D. torelliae. - C. *Pleotelsonic tubercles (dorsal view) of:* 1. D. bidentata. 2. D. torelliae. 3. D. magnitorata. 4. D. tubicauda. 5. D. edwardsi. 6. D. bifida.

rally, with tubercle above insertion in males. Pleotelsonic channel usually open posteriorly, dorsally, and ventrally in juveniles and immature females, but closed posteriorly in ovigerous females; in males channel usually closed posteriorly but open dorsally and ventrally; sides of channel with a rim in both sexes, trilobed in males.

Appendages. Except for the uropods all appendages are essentially similar in males and immature stages (Figs. 1, 3, 4). In ovigerous females the mouthparts become highly modified, oostegites are present at the bases of peraeopods 1-4, and the ischiopodites of all peraeopods gain a complement of long setae, (Holdich, 1968 a). *Antennules* with the first peduncular article large and tubular, the second much shorter but as wide as the first, the third extremely small

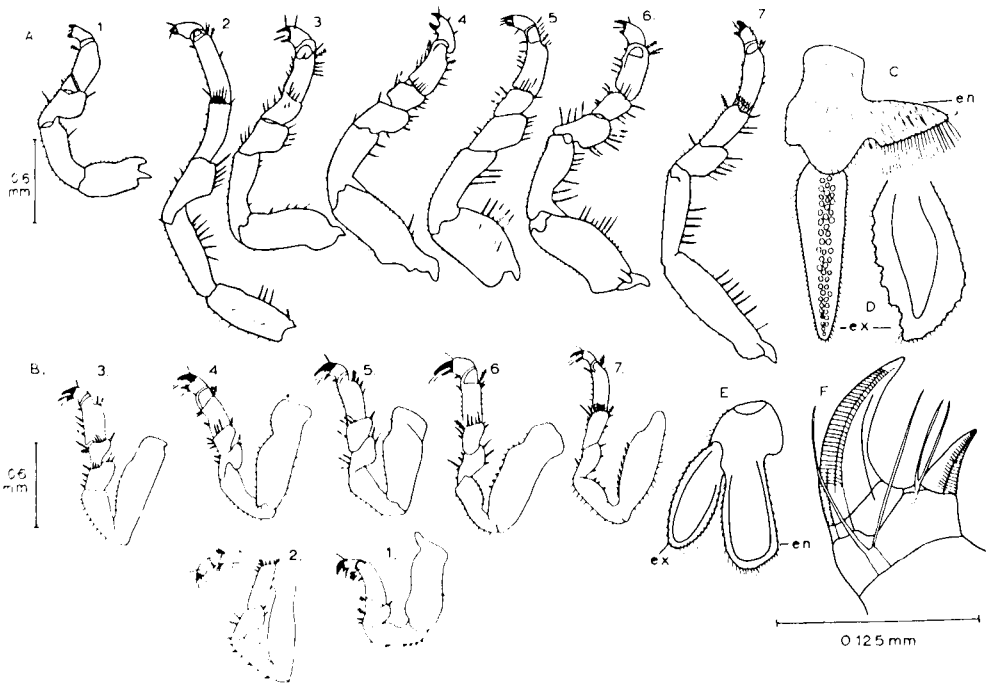

Fig. 3. *Peraeopods and uropods of male (A, C and D) and female (B and E)* D. bidentata. A. *Male peraeopods 1-7.* B. *Female peraeopods 1-7.* C. *Male uropod, dorsal (left).* D. *Exopodite of same, lateral view.* E. *Female uropod, dorsal (left).* F. *Ungulus of female peraeopod 4.* en., *endopodite;* ex., *exopodite.*

(Fig. 1 D); flagellum with 4-11 articles and from 2-12 aesthetases depending on age, (Fig. 1 E). *Antennae* with peduncular articles approximately equal, flagellar articles varying from 7-14 depending on age. *Labrum* heavily chitinized and bearing numerous spines and setae (Fig. 1 B). *Paragnaths* consisting of a pair of cup-shaped structures separated anteriorly by a setose channel (Fig. 1 C). *Mandibles* asymmetrical, the left with two incisor processes, the right with one; lacinia mobilis, molar process, and palp of each well developed (Fig. 1 F; Holdich, 1968 a). *Maxillules* with endopodite narrow and two jointed, with four plumose apical setae; exopodite larger with a number of heavily chitinised apical incisor teeth (3), movable spines (4), toothed spine (1), and ridged spines (3)

(HOLDICH, 1968 a). *Maxillae* bilobed, smaller and more delicate than the other mouthparts; outer lobe of two endites with apical ridged spines (HOLDICH, 1968 a). *Maxillipedes* with broad but short coxopodite bearing a large rectangular basipodite, and a similarly sized apical lamina fringed with numerous spinous tubercles and setae, and with one small median coupling hook; palp of four articles, three of which are lobed, the second usually being slightly longer than the first and third, all with long apical setae (Fig. 9; HOLDICH, 1968 a). *Peraeopods* simple,

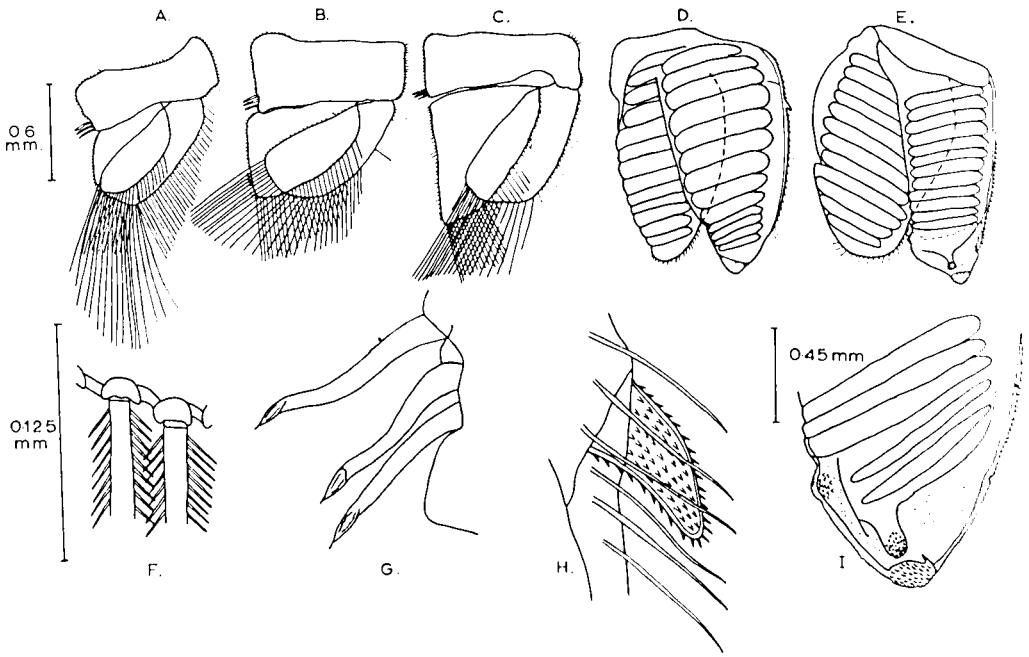

FIG. 4. *Pleopods of male* D. bidentata. A - E. *Pleopods 1-5*. F. *Bases of 2 plumose setae on pleopod 1*. G. *Coupling hooks on propodite of pleopod 2*. H. *Detail of process on outer edge of the exopodite of pleopod 4*. I. *Detail of the ventral distal part of expodite of pleopod 5*.

dactylopodite with a two clawed ungulus (Fig. 3 F); first shorter and thicker than remainder and with third distal article triangular (Fig. 3 A1, B1); second and seventh longest and bearing many more plumose setae particularly at the joint between the propodite and carpodite (Fig. 3). *Pleopods* 1 - 3 laminate, with numerous apical setae arising from small socket like joints (Fig. 4 A-C, F), endites unjointed, protopodite usually with three coupling hooks (Fig. 4 G); pleopod 2 without an appendix masculina. Pleopods 4 and 5 thick with transverse folds, and lacking long plumose setae; exopodite of pleopod 4 with apical toothed area and a lateral conical projection bearing concentric rows of spines (Fig. 4 D, H); exopodite of pleopod 5 with apical toothed area, extending medially and onto a prominent apical projection (Fig. 4 E, I). *Uropoda* varying greatly

with sex (Fig. 3 C, E) and, in males, from species to species. Females and juveniles with both endites laminate and marginally hirsute, exopodite lanceolate and movable and endopodite apically truncated and fused to the protopodite. Males with exopodite broadly laminate (Fig. 3 C, D), or tubular and tapered (Figs. 7, 9); endopodite rectangular (Fig. 6) or triangular (Fig. 5), fused to the protopodite at right angles to the exopodite, usually with a small smooth apical projection, both endites extremely hirsute.

Species diagnoses

Of more than forty species in the literature attributed to this genus only four now remain. These are *D. bidentata, D. edwardsi, D. ramuscula,* and *D. bifida,* and the validity of the last is open to some doubt. To these may be added three new species obtained during the present investigation and here described for the first time, namely, *D. torelliae, D. tubicauda,* and *D. magnitorata.*

Past confusion in the identification of *Dynamene species* is reflected in the extensive synonymies given for *D. bidentata* (see below) and the many sphaeromid isopods wrongly attributed to this genus (Table I).

Table I. *Sphaeromid isopods which so far as is known have been mistakenly attributed to the* Dynamene *genus.*

Naesa caudata Say, 1818 = *Paracerceis caudata* (Say) Hansen, 1905.
Naesa ovalis Say, 1818 = *Cassidinidea ovalis* (Say) Hansen, 1905.
Naesa depressa Say, 1818 = *Ancinus depressa* (Say) Hansen, 1905.
Dynamene lesueuri (Risso) Desmarest, 1825 = *Cymodoce lesueuri* (Risso) Milne-Edwards, 1840.
Naesa latreille (Leach) Milne-Edwards, 1840 = *Cymodoce* sp.
Naesea angulosa (male) Hesse, 1873 = *Campecopea hirsuta.*
Naesea angulosa (female) Hesse, 1873 = *Ischyromene lacazei* Racovitza.
Dynamene eatoni Miers, 1876 = *Dynamenella eatoni* (Miers) Hansen, 1905.
Dynamene huttoni Thomson, 1879 = *Dynamenelle huttoni* (Thomson) Yonge, 1927.
Naesa canaliculata Thomson, 1879 = *Cilicaea canaliculata* (Thomson) Hansen, 1905.
Dynamene darwini (Cunningham) Miers, 1881 = *Euvallentina darwini* (Cunningham), Menzies, 1961.
Dynamene corallina Gourret, 1891 = *Cymodoce* sp. Hansen, 1905.
Dynamene setosa Gourret, 1891 = *Cymodoce* sp. Hansen, 1905.
Dynamene benedicti Richardson, 1899 = *Dynamenella benedicti* (Rich.) Hansen, 1905.
Dynamene dilatata Richardson, 1899 = New genus? Hansen, 1905.
Dynamene glabra Richardson, 1899 = *Dynamenella glabra* (Rich.) Hansen, 1905.
Dynamene tuberculosa Richardson, 1899 = *Cilicaea cordata* (Rich.) Richardson, 1905.
Dynamene bermudensis Richardson, 1901 = *Paracerceis bermudensis* (Richardson) Hansen, 1905.
Dynamene angulata Richardson, 1901 = *Dynamenella angulata* (Rich.) Hansen, 1905.
Dynamene perforata Moore, 1902 = *Dynamenella perforata* (Moore) Hansen, 1905.
Dynamene sculpta Holmes, 1904 = *Paracerceis sculpta* (Holmes) Hansen, 1905.
Dynamene cordata (Richardson) Holmes, 1904 = *Paracerceis cordata* (Rich.) Richardson, 1905.
Dynamene sheari Hatch, 1947 = *Dynamenella* sp.

Dynamene bidentata (ADAMS, 1800). Type species.

SYNONOMY: *Oniscus bidentatus* ADAMS, 1800

Oniscus ruber MONTAGU, 1800?

Nesaea bidentata LEACH, 1814; WHITE, 1850, 1857.

Naesa bidentata LEACH, 1815, 1818; TEMPLETON, 1836; COCKS, 1849; GOSSE, 1855; BATE and WESTWOOD, 1868; PARFITT, 1874; EDWARD, 1876; BATE, 1878; KOEHLER, 1885; BARROIS, 1888; STEBBING, 1893, 1905 b; WALKER, 1896, 1898; TOMPSON, 1901; TATTERSALL, 1905; MARINE BIOLOGICAL ASSOCIATION, 1904-6; NORMAN and SCOTT, 1906; SINEL, 1906; SCOTT, 1906; NORMAN, 1907; OMER-COOPER, 1917; COLMAN, 1940; PYEFINCH, 1943; GLYNNE-WILLIAMS and HOBART, 1962; WIESER, 1952, 1962, 1963; MORTON, 1954; NAYLOR and QUÉNISSET, 1964.

Nesa bidentata LEACH, 1814.

Naesea bidentata HESSE, 1873.

Dynamene montagui LEACH, 1818; BATE and WESTWOOD, 1868; PARFITT, 1874; STEBBING, 1874, 1893; BATE, 1878; KOEHLER, 1885; BARROIS, 1888; WALKER, 1892, 1896; NORMAN and SCOTT, 1906.

Dynamene viridis LEACH, 1818; BATE and WESTWOOD, 1868; PARFITT, 1874; STEBBING, 1874; 1893, 1905 a; BUTLER, 1878; KOEHLER, 1885; BARROIS, 1888; ROBERTSON, 1890.

Dynamene rubra LEACH, 1818; BATE and WESTWOOD, 1868; BRADY and ROBERTSON, 1869; PARFITT, 1874; STEBBING, 1874, 1893; EDWARD, 1876; BARROIS, 1888; ROBERTSON, 1890; WALKER, 1892, 1896, 1898.

Dynamene varians STEBBING, 1874.

Dynamene bidentata STEBBING, 1905 b; HANSEN, 1905; STEBBING, 1906 a, 1906 b; TATTERSALL, 1912; CAULLERY and MESNIL, 1919, 1920; MONOD, 1923 a and b, 1932; OMER-COOPER and RAWSON, 1934 (excluding figure); HOLTHUIS, 1949, 1952, 1956 (excluding figure); MARINE BIOLOGICAL ASSOCIATION, 1957; BARRETT and YONGE, 1964 (excluding figure); TINTURIER-HAMELIN, 1962, 1967; BRUCE, COLMAN and JONES, 1963; BOURDON, 1964; CROTHERS, 1966.

Sphaeroma bidentata, S. montagui BOSC, 1830.

Sphaeroma dydima, S. micracantha, S. sp. TRISTAN, 1809.

Cymodoce rubra, C. viridis, C. montagui WHITE, 1847, 1850, 1857; COCKS, 1849.

Male neotype (Fig. 5 D): *Body* hirsute only around the pleural margins and uropoda. Length averages 6 mm. *Peraeon* with fairly short bidentate process not reaching the pleotelsonic tubercle, each branch tapered, rugose dorsally, and without prominent projection at the apex (Figs. 2 A1; 5 D, E). Tergopleural

processes of somite 7 separated by a shallow cleft, lower projection much wider than upper (Fig. 2 B5). *Pleotelson* rugose, with a prominent posterior tubercle, comprising two rounded rugose structures united at the base (Fig. 2 C1,

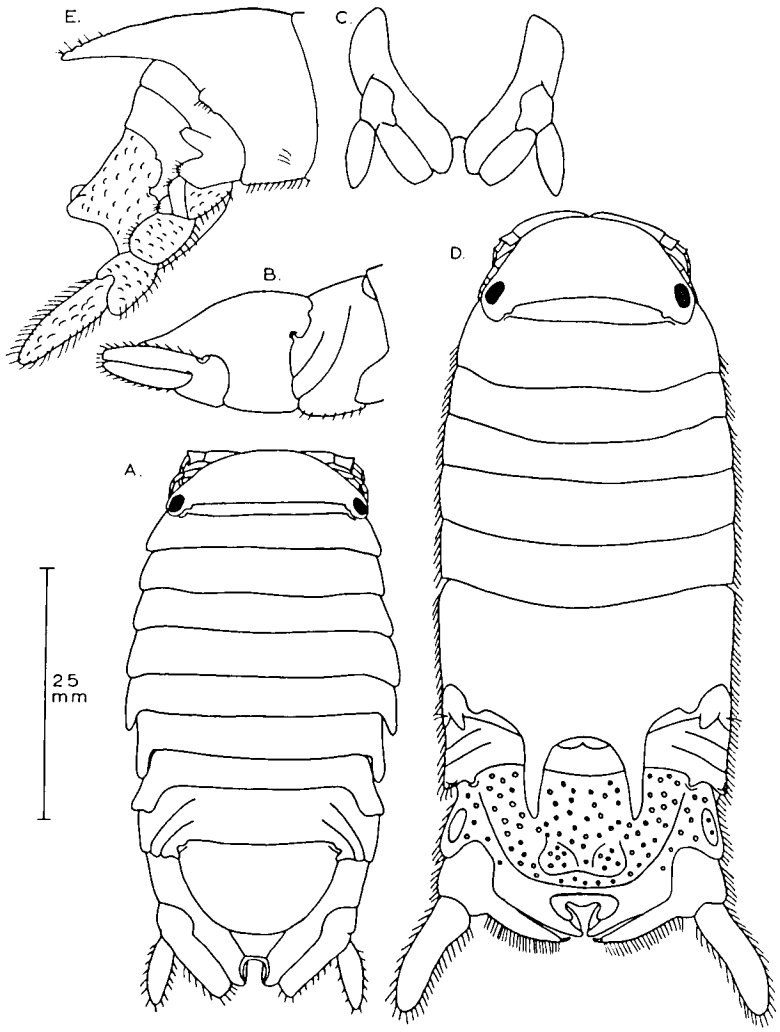

FIG. 5. *Type species* D. bidentata. A. *Female (non-ovigerous) dorsal.* B. *Female pleon and pleotelson, lateral view.* C. *Female pleotelson, ventral.* D. *Mature male, dorsal.* E. *Posterior end of a mature male in lateral view, showing the bidentate process and pleotelsonic tubercle.*

Fig. 5 D, E); channel open dorsally and ventrally, rim well defined (Fig. 5 D). *Appendages.* Maxillipede with basipodite and apical lamina approximately equal in length (Table II), lobes on palp long and fairly thick (HOLDICH, 1968 a). Uropodal exopodite broadly laminate, appearing lanceolate from above, endo-

podite triangular, (Fig. 3 C, D). Other appendages as in generic description (Figs. 3, 4).

Female (Fig. 5 A): *Body* hirsute only around the margins of uropoda. *Pleotelson* smooth, rounded and without median keel (Fig. 5 A, B); channel widely open dorsally, ventrally and posteriorly (Fig. 5 A, C), closed posteriorly in

TABLE II. *Relative lengths of the coxopodite, basipodite, and apical lamina of the maxillipede of six* Dynamene *species.*

Species	Coxopodite	Basipodite	Apical lamina
BIDENTATA	1	8.5	8
EDWARDSI	1	5	3.8
BIFIDA	1	5	4.5
TORELLIAE	1	6	5.5
TUBICAUDA	1	5	6
MAGNITORATA	1	6	6

ovigerous females. *Appendages.* Maxillipede as in male and other appendages as in the generic description (Figs. 3, 4).

Colour of both sexes variable, usualy green or yellow in females and mottled orange in males, ovigerous females colourless. A number of phenotypic varieties are recognisable (HOLDICH, 1968 b).

Habitat varies with age, juveniles occurring among intertidal algae and adults in crevices and empty barnacle shells. Entirely intertidal (HOLDICH, 1969 b).

Distribution confined to British Isles and Atlantic coasts of France, Spain, Portugal and possibly north-western Africa; probably not in the Mediterranean or Black Sea (HOLDICH, 1969 b).

Type - no record. *Neotype* - British Museum (Crustacea Section) Ref. 1968 1.3.1.

Type locality - Milford Haven.

Dynamene edwardsi (LUCAS, 1849)

SYNONOMY: *Naesea edwardsi* LUCAS, 1849.
Naesea subviridiscutata HESSE, 1873.
Dynamene hanseni MONOD, 1923 b.
Dynamene edwardsi TORELLI, 1930; MONOD, 1932.
Dynamene sp MONOD, 1932, Figs. 57, 58 b, 59 C-E.

Male (Fig. 6 E). *Body* proportionately wider than the type species, hirsute dorsally, laterally and around the pleural margins. Length averages 5.4 mm. *Peraeon.* Branches of the bidentate process reaching the level of the pleotelsonic tubercle, branches thickest at apices and each with a small downwardly directed

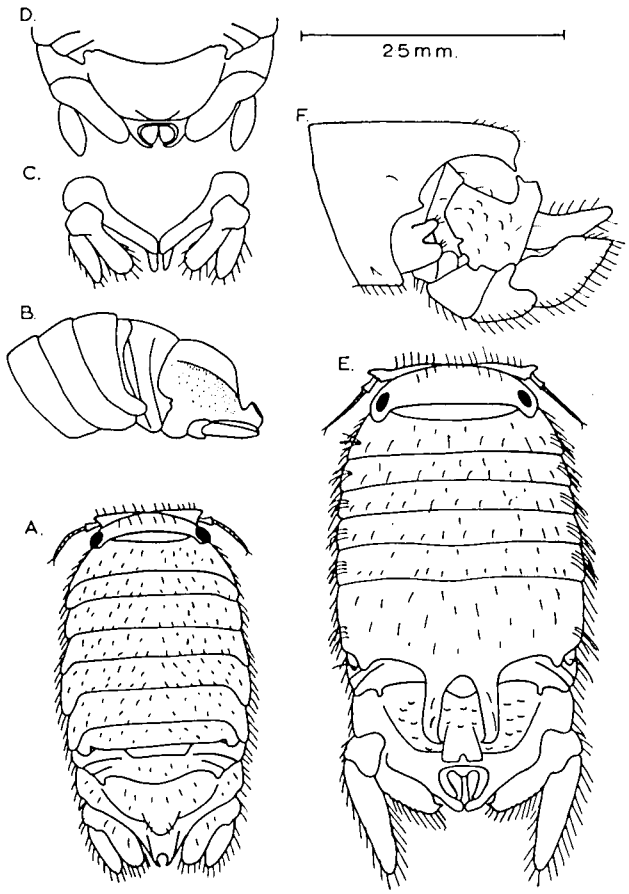

FIG. 6. D. edwardsi. A. *Female (non-ovigerous) dorsal.* B. *Female, posterior body showing pleotelsonic keel and channel, lateral.* C. *Female pleotelson, ventral.* D. *Ovigerous female pleotelson, dorsal.* E. *Mature male, dorsal.* F. *Posterior end of mature male in lateral view showing bidentate process and pleotelsonic tubercle.*

process; only slightly rugose (Fig. 2 A2; Fig. 6 E, F). Tergopleural processes of somite 7 separated by a deep cleft, lower projection slightly wider than upper (Fig. 2 B2; Fig. 6 F). *Pleotelson* moderately rugose, with a prominent posterior tubercle, comprising a wedge-shaped projection, widest posteriorly (Fig. 2 C5; Fig. 6 E, F); channel similar to that in the type species (Fig. 6 E). *Appendages.* Maxillipede with basipodite longer than apical lamina (Table II), lobes on palp

all well developed. Uropodal exopodite broadly laminate, wider than that of type; endopodite rectangular. Other appendages as in generic description.

Female (Fig. 6 A). *Body* hirsute dorsally, laterally, and around pleural margins. Length averages 4.3 mm. *Pleotelson* with median keel (Fig. 6 A, B), but reduced in ovigerous females (Fig. 6 D); channel tubular (Fig. 6 A, B, C) reduced and partially closed ventrally in ovigerous females (Fig. 6 D). *Appendages*. Maxillipede as in male; other appendages as in generic description.

Colour of both sexes generally dull grey, but with phenotypic varieties (HOLDICH, 1968 b).

Habitat — Juveniles on algae, adults in crevices and empty barnacle shells. Occurring in both intertidal and shallow water localities (HOLDICH, 1969 b).

Distribution — Ranges from the Mediterranean southwards to north-western Africa and northwards to north-western France (HOLDICH, 1969 b).

The type material was collected at Bone (Tunisia) by DESHAYES (LUCAS, 1849) but the whereabouts of the specimens are unknown. The Paris Natural History Museum has material, and specimens collected in the present investigation have been deposited in the British Museum, and at the museum of the Stazione Zoologica, Naples.

Dynamene ramuscula (BAKER, 1908)

SYNONOMY: *Dynamene ramuscula* HALE, 1929; NIERSTRASZ, 1931; MONOD, 1932.

Known only from descriptions by BAKER (1908) and HALE (1929) of a single mature male and two ovigerous females. The following account is based on these descriptions.

Male. Body strongly convex, covered sparsely with long setae. Length 5 mm. *Peraeon* with arms of bidentate process nearly reaching the end of the pleotelson, each branch sinuous in shape, with a small downwardly directed branch near the apex. *Pleotelson* rugose and hirsute, having a median tubercle and two lateral pairs, the anterior pair being larger and closer together. Pleotelsonic channel closed ventrally for the whole of its length, ending in a circular foramen situated on a conical terminal projection. *Appendages*. Uropodal exopodite straight and lanceolate, much narrower and longer than the endopodite.

Female (ovigerous). *Pleotelson* with channel in the shape of a triangle, almost closed behind; posterior pleotelson with a low median tubercle. *Appendages*. Mouthparts highly modified.

Colour unknown.

Habitat: On sponges.

Distribution: south-eastern Australia.

Type: whereabouts unknown. *Type locality*: Gulf St. Vincent (S.E. Australia).

D. ramuscula BAKER (1908) and *D. bifida* TORELLI (1930) appear to be very similar but it is not known, as yet, whether they are one and the same species.

Dynamene bifida TORELLI 1930

Described by TORELLI from a single male but found in the present investigation to be fairly common in the Bay of Naples. The ovigerous female is described here for the first time.

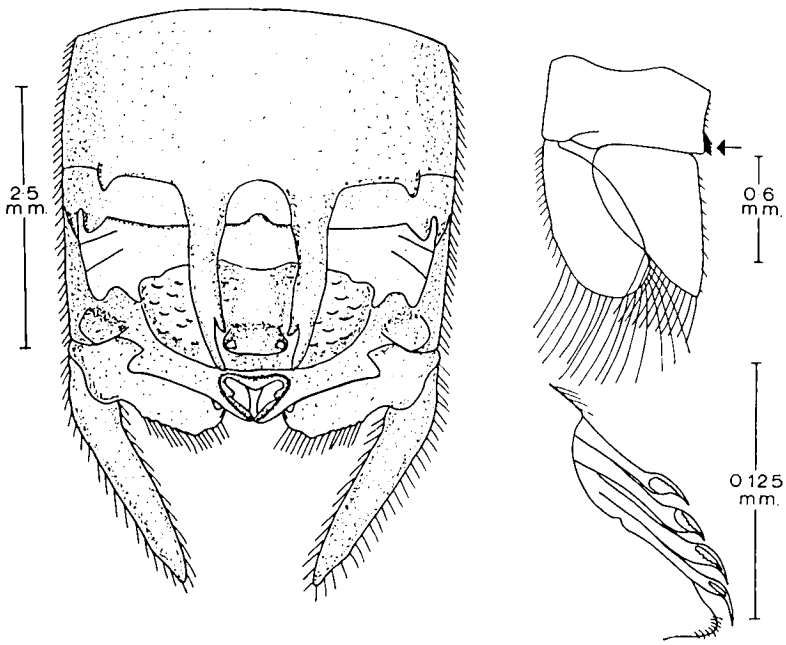

FIG. 7. D. bifida, *mature male, showing dorsal view of posterior end including bidentate process and pleotelson (left); and third pleopod (upper right), with enlargement of the four coupling hooks on the protopodite (lower right).*

Male neotype (Fig. 7). Body shape and degree of hirsutness similar to that of the type species. Length averages 7.5 mm. *Peraeon* with large bidentate process, the branches of which extend beyond the level of the pleotelsonic tubercle; each branch swollen slightly in the centre, moderately rugose, tapering to a point but with a prominent curved, downwardly directed projection near the apex (Figs. 2 A6; 7). Tergopleural processes of somite 7 with lower projection larger than upper (Fig. 2 B1) separated by a wide, deep cleft. *Pleotelson* only slightly rugose; posterior tubercle triangular, widest posteriorly (Fig. 2 C6).

Appendages. Maxillipede with basipodite slightly longer than the apical lamina (Table II), first proximal lobe on the palp shorter than the third. Pleopods 1-3 with four coupling hooks on the inner edge of the protopodite (Fig. 7). Uropodal exopodite tubular and lanceolate; endopodite rectangular, apex hooked. Other appendages as in generic description.

Female (ovigerous). *Body* hirsute dorsally, laterally and around pleural margins. Length averages 5.5 mm. *Pleotelson* with a vestigial keel; channel closed postero-ventrally. *Appendages.* Maxillipede and pleopods as in male; other appendages as in generic description.

Colour — sandy yellow.

Habitat — adult among empty barnacle shells and *Hydroides* colonies (HOLDICH, 1969 b).

Distribution — Mediterranean (HOLDICH, 1969 b).

Type — not tracable at Naples. Present description of neotype now deposited in the museum of the Stazione Zoologica, Naples. *Type locality*: Cape Posillipo, Naples.

Dynamene torelliae n. sp.

SYNONOMY: *Naesa bidentata* COSTA, 1838.

Naesa bidentata HOPE, 1851.

Dynamene bidentata TORELLI, 1930; OMER-COOPER and RAWSON, 1934, Plate V; PAULI, 1954, Fig. 14; HOLTHUIS, 1956, Fig. 19; BARRETT and YONGE, 1964, Plate VIII.

Male holotype (Fig. 8 D). *Body* hirsute dorsally, laterally and around pleural margins; strongly convex. Length averages 4 mm. *Peraeon* with branches of bidentate process short and widely separated, each branch extremely rugose and tapered (Fig. 2 A3). Tergo-pleural processes of somite 7 almost equal in width and separated by a deep narrow cleft (Fig. 2 B6). *Pleotelson* rugose, posterior tubercle with wide stem divided distally into two projections separated by a shallow U-shaped cleft (Fig. 2 C2). *Appendages.* Maxillipede with basipodite only slightly longer than the apical lamina, lobes of palp narrower than is usual. Uropodal exopodite narrowly laminate with parallel sides and truncated apex. Other appendages as in generic description.

Female (Fig. 8 A). *Body* hirsute as in male. Length averages 3.6 mm. *Pleotelson* with median keel (Fig. 8 A, B); channel similar to that of the type species but with slightly longer roof (Fig. 8 C). *Appendages.* Maxillipede as in male; other appendages as in generic description.

Colour — yellow or dull green, with phenotypic varieties (HOLDICH, 1968 b).

Habitat — among shallow water algae and crevices (HOLDICH, 1969 b).

Distribution — Mediterranean, Agean, and probably the Black Sea (HOLDICH, 1969 b).

Holotype — deposited in British Museum (Crustacea Section) Ref. 1968 1.3.19,

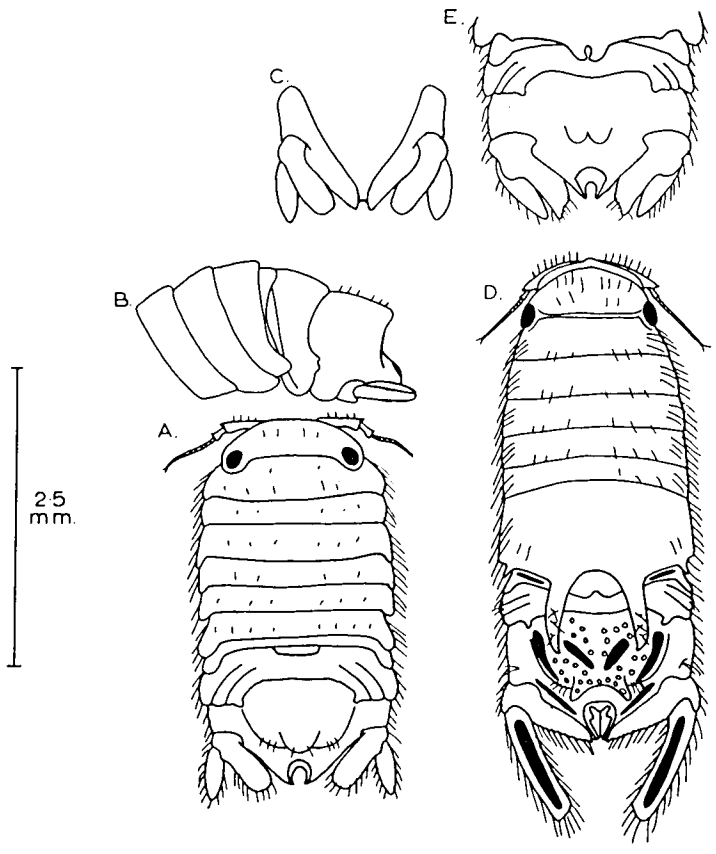

FIG. 8. D. torelliae. A. *Female (non-ovigerous) dorsal.* B. *Female, posterior body showing pleotelsonic keel and channel, lateral.* C. *Female pleotelson, ventral.* D. *Mature male, dorsal.* E. *Dorsal view of posterior end of an immature male.*

with paratypes Ref. 1968. 1.3.20-21. Other paratypes deposited in the museum of the Stazione Zoologica, Naples. *Type locality*: Mergellina Harbour, Naples.

Dynamene tubicauda n. sp.

So far known only from three mature males from two separate localities on opposite sides of the Bay of Naples.

Male holotype (Fig. 9). *Body* with pronounced dorso-ventral flattening;

width at the level of the peraeonal somite 6 almost equal to the total peraeon length; front of head and pleura expanded laterally to form an almost continuous shelf around the body; hirsute around the pleural margins and with a few dorsolateral patches of setae. Length averages 3.5 mm. *Peraeon* with bidentate process reaching the anterior border of the pleotelsonic shelf; bran-

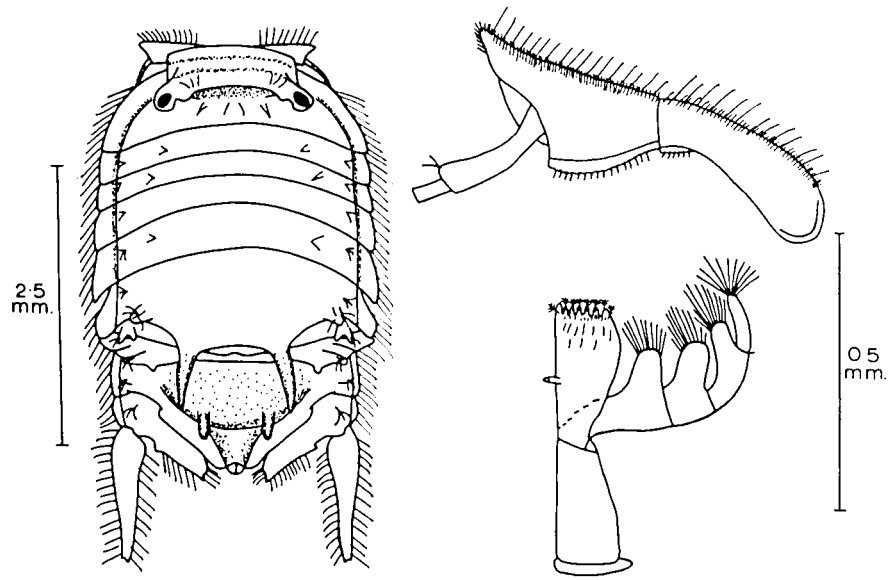

FIG 9. D. tubicauda, *mature male, dorsal (left); antennular peduncle (upper right), and right maxillipede (lower right).*

ches widely separate, moderately rugose and tapering (Fig. 2 A5). Tergo-pleural processes of somite 7 separated by a shallow cleft (Fig. 2 B4). *Pleotelson* moderately rugose posterior tubercles diagnostic, in the form of two separate tubular projections arising on either side at the base of the pleotelsonic channel (Fig. 2 C4; 9). The channel is the form of a tube opening anteriorly into the respiratory chamber and posteriorly beyond the level of the pleotelsonic shelf, which is continuous under the tube (Fig. 9). *Appendages*. Article 2 of the antennular peduncle with a keel, articles 1 and 2 hirsute anteriorly (Fig. 9). Basipodite of maxillipede shorter than the apical lamina (Table II), lobes on palp all well developed (Fig. 9). Uropodal exopodite tubular; endopodite rectangular and lacking smooth apical projection present in all other males of this genus. Other appendages as in generic description.

Colour — pale yellow.

Habitat — in rock scrapings from 5 metres and 30 metres (HOLDICH, 1969 b).

Distribution — Mediterranean (HOLDICH, 1969 b).

Holotype deposited in British Museum (Crustacea Section). Ref. 1968. 1.3.22.

Type locality — Punta Tiberio, Capri (Bay of Naples). *Paratype* deposited in the museum of the Stazione Zoologica, Naples.

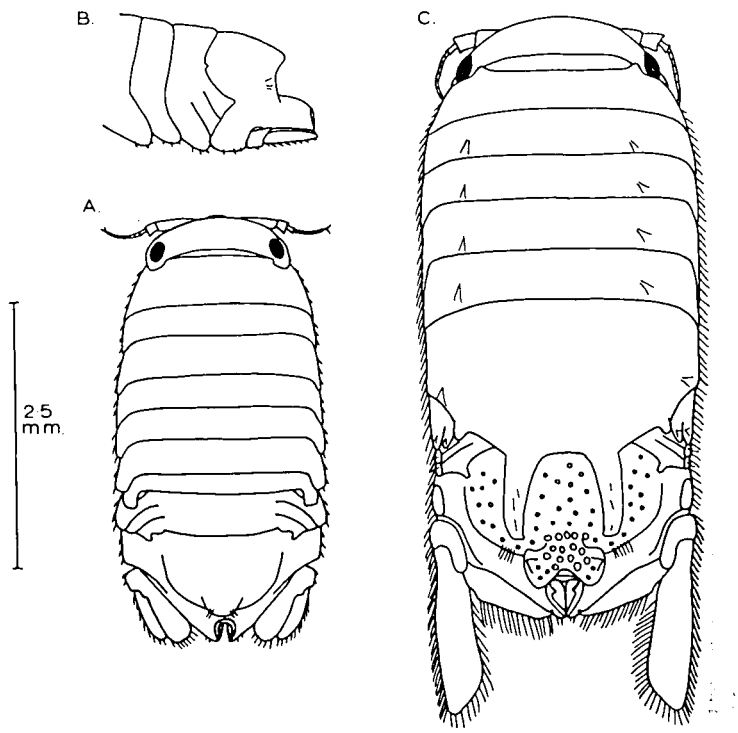

FIG. 10. D. magnitorata. A. *Female (non-ovigerous) dorsal.* B. *Female, posterior body showing pleotelsonic keel and channel, lateral.* C. *Mature male, dorsal.*

Dynamene magnitorata n. sp.

SYNONOMY: *Dynamene bidentata* MONOD, 1932, Fig. 59 A, B.

Known from specimens kindly sent to me on loan by Dr. L. B. HOLTHUIS from the Natural History Museum, Leiden. Subsequently specimens have been found in collections of Professor T. MONOD and Dr. M. LEDOYER. All the above material was labelled *D. bidentata.*

Male holotype (Fig. 10 C). *Body* very similar to that of type species; pleural margins hirsute, and pair of lateral setae on each peraeonal somite. Length averages 5.9 mm. *Peraeon* with bidentate process reaching the level of the posterior pleotelsonic tubercle; branches extremely rugose apically, blunt

(Fig. 2 A4). Tergo-pleural processes of somite 7 separated by a deep, wide cleft (Fig. 2 B3). *Pleotelson* rugose and with two patches of setae on either side of the posterior pleotelsonic tubercle; tubercle large and prominent with narrow stem expanded apically into two lateral, rugose structures separated by a U-shaped cleft; each with a small dorsal secondary tubercle (Figs. 2 C3; 10 C). Pleotelsonic channel similar to that of the type species. *Appendages.* Maxillipedal

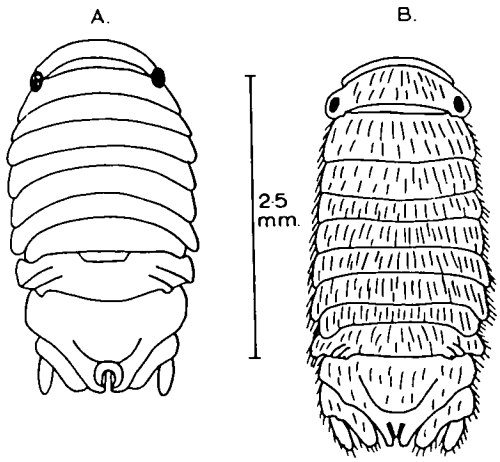

FIG. 11. Dynamene *spp.* A. *Juvenile from Tangiers, (Prof. Th.* MONOD's *collection).* B. *Juvenile from the Balearic Islands (British Museum), collected by Imperial College, London.*

basipodite and apical lamina equal in length, third palp lobe shorter than first. Uropodal exopodite broadly laminate, endopodite triangular. Other appendages as in generic description.

Female (Fig. 10 A). *Body* similar to that of the type species; pleural margins and postero-lateral sides of the pleotelsonic keel hirsute. Length averages 4.8 mm. *Pleotelson* with medio-dorsal keel (Fig. 10 A, B); channel with a more elongate rim than of the type. *Appendages.* Maxillipede as in male, other appendages as in generic description.

Colour — yellow or light green, with phenotypic varieties (HOLDICH, 1968 b).

Habitat — intertidal algae and crevices, and similar in shallow water in the Mediterranean (HOLDICH, 1969 b).

Distribution — so far recorded from the Mediterranean, Roscoff, N.W. Africa and Point Barfleur (northern France) (HOLDICH, 1969 b).

Holotype deposited in Natural History Museum, Leiden, Ref. No. 1: 1695, also paratypes Ref. Nos. 1: 1696, 1697.

Type locality — Roscoff.

Dynamene spp.

Two specimens have been found in collections from Tangiers (Fig. 11 A) and the Balearic Islands (Fig. 11 B). Both are juveniles but do not fit any of the species described so far.

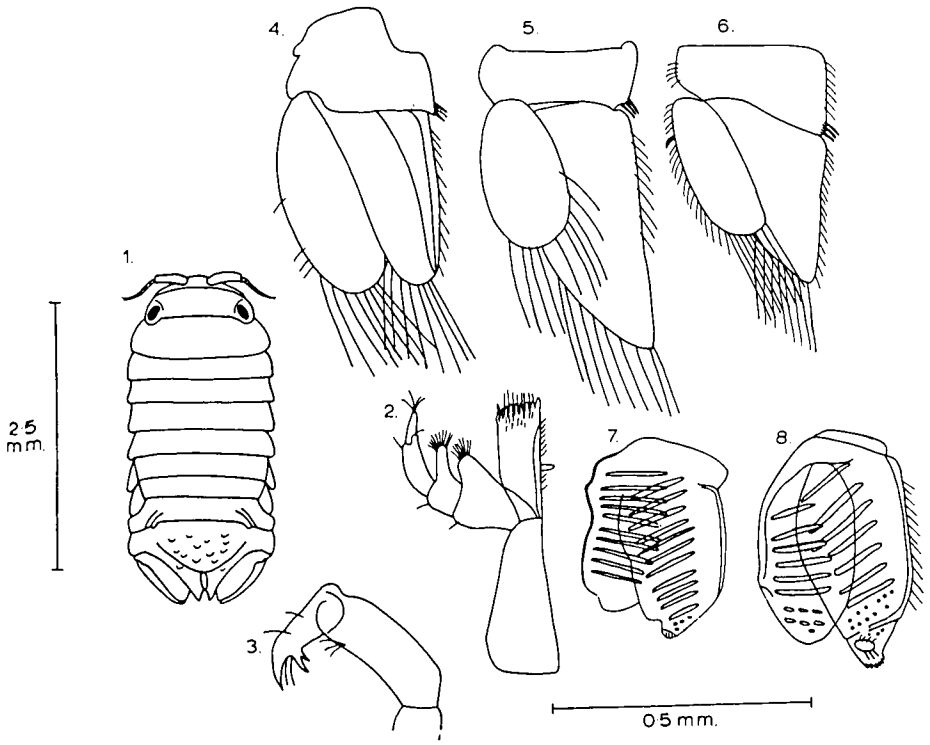

FIG. 12. Ischyromene lacazei, *juvenile*. 1. *Juvenile, dorsal*. 2. *Left maxillipede*. 3. *Dactylus of peraeopod 1, showing double inner claw*. 4. - 8. *Pleopods 1-5*.

MORTON and MILLER (1968) figure an adult male *Dynamene* sp. but this was taken from HALE (1929) (MILLER personal communication) and does not necessarily occur in New Zealand.

MONOD (1932) figures a species (Fig. 58 a) which appears to be of this genus but examination of the material revealed that it was a juvenile or female *Ischyromene lacazei* RACOVITZA 1908. A figure of this specimen is included here (Fig. 12) to avoid confusion in identification of *Dynamene* species.

KEY TO THE EUROPEAN SPECIES OF THE GENUS DYNAMENE

Both endites of pleopods 4 and 5 transversely folded. Pleotelsonic channel deep in male and female, never with large median projection, closed posteriorly

in most adults. Pleotelson never rugose in females but often with a mediodorsal keel. Large posterior tubercle or pair of tubercles on pleotelson of male. Male peraeonal somite 6 with large backwardly directed bidentate process. Pleopod 2 in male without appendix masculina and with both endites approximately equal in size. Ovigerous females always white in colour, with metamorphosed mouthparts.

1. Peraeon width and length almost equal; pleura and front of head expanded into a shelf . . . . . *D. tubicauda.* (male).

Peraeon width always shorter than length and body never surrounded by a shelf 2

2. Branches of peraeonal bidentate process of male markedly bifid. Protopodites of pleopods 1-3 with four coupling hooks . . . . *D. bifida*

(The Australian species *D. ramuscula,* which may be synonymous with *D. bifida,* would also key out here).

Branches of bidentate process not markedly bifid. Protopodite of pleopods 1-3 with three coupling hooks 3

3. Posterior pleotelsonic tubercle of male relatively sessile, bluntly bilobed (Fig. 2 C1). Branches of bidentate process only moderately rugose and without prominent apical projections (Fig. 2 A1). Females and juveniles without pleotelsonic keel . . . . . *D. bidentata.*

Posterior pleotelsonic tubercle of male stalked (Fig. 2 C3) or, if sessile, with pointed lobes (Fig. 2 C2). Branches of bidentate process usually extremely hirsute, and always with a pronounced apical projection. Females and juveniles with pleotelsonic keel . . . . . 4.

4. Apices of bidentate process of male only slightly rugose, wider than base (Fig. 2 A2). Pleotelsonic channel in juveniles and females in the form of a tube projecting above the level of the pleotelsonic shelf . . . *D. edwardisi.*

Apices of bidentate process of male extremely rugose, narrower than base. Pleotelsonic channel in juveniles and females never in the form of a tube projecting above the level of the pleotelsonic shelf . . . . . 5.

5. Posterior pleotelsonic tubercle of male stalked and bluntly bilobed (Fig. 2 C3). Lobes on maxillipedal palp thick, first longer than third *D. magnitorata.*

Posterior pleotelsonic tubercle of male sessile, with two pointed lateral projections separated by a shallow U-shaped cleft. Lobes on maxillipedal palp narrow, first as long as third . . . . . *D. torelliae.*

Discussion

Although *D. bidentata* was discovered in 1800 (Adams) it was not until 1868 (Bate and Westwood) that any recognisable figures were published. Torelli (1930) gave the first detailed description and figures under this name. Subsequent workers have tended to use Torelli's paper as a basis for identication but it seems clear from present investigations that the species described by Torelli as *D. bidentata* was in fact *D. torelliae* n. sp. For this reason figures and descriptions of *D. bidentata* in Omer-Cooper and Rawson (1934), Pauli (1954), Holthuis (1956), and Barrett and Yonge (1964) are somewhat invalid.

Hesse (1873) described a number of new species for this genus. Reappraisal of this work has shown that the majority of species are colour morphs and immature specimens of *D. bidentata* (Torelli, 1930; Monod, 1932; Omer-Cooper and Rawson, 1934). In addition it seems likely that Hesse's female *Naesea* (= *Dynamene*) *angulosa* is synonymous with *Ischyromene lacazei* Racovitza (1908) and his *N. subviridiscutata* may be synonymous with *Dynamene edwardsi* (female). Hesse's *N. contracta*, although recognised as a definite species by Dollfus (1888) is probably synonymous with *D. bidentata*.

A character used by Monod (1923 b) to separate *D. bidentata* from *D. hanseni* (= *D. edwardsi*) was the relative lengths of the articles of the maxillipedes. Although the present results are different from those of Monod it can be seen that this character is useful in distinguishing *D. edwardsi* from all the other species (Table II).

A number of workers have used the degree of lobulation on the maxillipedal palp to separate sphaeromid genera and species (Richardson, 1905; Verhoeff, 1942) and this character is of some value in separating species of *Dynamene* females. Pronounced maxillipedal lobes are present in most species, with the second lobe generally being slightly longer than the first and third. In *D. torelliae* all the lobes are narrow ,in *D. bifida* the first proximal lobe is noticeably shorter than the remainder, and in *D. magnitorata* the third lobe is very small.

Torelli (1930) used the shape of the tergo-pleural projections of peraeonal somite 7 in distinguishing male *D. edwardsi* from males of her *D. bidentata* (= *D. torelliae*). She stated that in the former the upper projection was divided by a suture. Unfortunately although there are some slight differences (Fig. 2 B) in this character between the two species, the suture described by Torelli has not been observed in the present material. The shape of the two projections has, however, been shown to vary with the species and to be of taxonomic value.

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References

Adams, J., 1800: Description of some marine animals found on the coast of Wales. Trans. Linn. Soc. London. **5**, 7-13.

Baker, W. H., 1908: Note on some species of the Isopod family Sphaeromidae, from the South Australian coast. Trans. Roy. Soc. S. Australia **32**, 138-162.

Barrett, J., and C. M. Yonge, 1964: Collins pocket guide to the sea-shore. 272 pp. Collins, London.

Barrois, T., 1888: Catalogue des Crustacés marins recueillis aux Açores durant les mois d'août et september 1887. 110 pp. Lille.

Bate, C. S., 1878: Crustacea revised and added to, in J. Couch « The Cornish fauna: a compendium of the Natural History of the county ». 2nd Ed., 56-127. Royal Institution of Cornwall, Truro.

Bate, C. S., and J. O. Westwood, 1868: A history of the British sessile-eyed crustacea. Vol. **2**. 536 pp. London.

Bosc, L. A. G., 1830: Manuel de l'histoire des Crustaces, etc. edition mise au niveau des connaissances actuelles par A. G. Desmarest (ed.) Vol. **1**, 151-152.

Bourdon, R., 1964: Notes sur la biologie de *Dynamene bidentata* Adams (Isopoda, Sphaeromatidae). Bull. trimest, Acad. Soc. lorraines Sci. **4** (1), 155-162.

Brady, C. S., and D. Robertson, 1869: Notes on a week's dredging in the West of Ireland. Ann. Mag. Nat. Hist. Ser. 4, **3**, 353-374.

Bruce, J. R., J. S. Colman and N. S. Jones, 1963: Marine Fauna of the Isle of Man. 307 pp. Liverpool.

Butler, E. A., 1878: The Natural Hisory of Hastings and St. Leonards and the vicinity. 1st Suppl. 1878: 45.

Caullery, M. and F. Mesnil, 1919: Sur un nouvel Épicaride (*Ancyroniscus bonnieri* n. g., n. sp.), parasite d'un Spheromide (*Dynamene bidentata* Mont.). C.r. hebd. Séanc. Acad. Sci., Paris, **169**, 1430-1432.

Caullery, M., and F. Mesnil, 1920: *Ancyroniscus bonnieri* C. and M. Épicaride parasite d'un Spheromide (*Dynamene bidentata* Mont.). Bull. Biol. Fr. Belg. **53(4)**, 1-36.

Cocks, W. P., 1849: Contributions to the fauna of Falmouth. Ann. Rep. Roy. Cornwall Polytechnic Soc. 1848, 38-101.

Colman, J. S., 1940: On the faunas inhabiting intertidal seaweeds. J. mar. biol. Ass. U.K. **24**, 129-183.

Costa, O. G., 1838: Fauna del regno di Napoli. Liv. 7. Crostacei, Cirripedi. Napoli.

Crothers, J. H. (Ed.), 1966: Dale Fort marine fauna (2nd. Edn.) Field Studies, **2** (suppl.), 169 pp.

Desmarest, A. G., 1825: Considérations général sur la classe des Crustacés et des description des especes de ces animaux qui vivent dans la mer, sur les côtes ou dans des eaux douces de la france. 446 pp. Strasbourg.

DOLLFUS, A., 1888: Les plages du Croisic. Feuille des Jeunes Nats. Ann. XVIII. No. **208**, 46-50.

EDWARD, T., 1876: Selections from the fauna of Banffshire. In S. Smiles Life of a Scottish Naturalist: Thomas Edward. 438 pp. London.

ELLIS, J. and D. SOLANDER, 1786: The natural history of many curious and uncommon Zoophytes. 207 pp. B. White and Son, London.

GLYNNE-WILLIAMS, J., and J. HOBART, 1952: Studies on the crevice fauna of a selected shore in Anglesey. Proc. zool. Soc. Lond. **122**, 797-824.

GOSSE, P. H., 1855: A manual of Marine Zoology for the British Isles. Pt. I, Fig. 237. London.

GOURRET, P., 1891: Les Lémodipodes et Isopodes du Golfe de Marseille. Ann. Mus. Nat. Marseille. Zool. **4**, 1-44.

HALE, H. M., 1929: The crustaceans of South Australia Pt. **2**, 269-310. Handbooks of the flora and fauna of South Australia. British Science Guid (S. Australia Branch), Adelaide.

HANSEN, H. J., 1905: On the propagation, structure and classification of the Family SHAEROMIDAE. Q. J. microsc. Sci. **49**, 69-135.

HATCH, M. H., 1947: The Chelifera and Isopoda of Washington and adjacent regions. Univ. Wash. Pub. Biol. **10** (5), 155-274.

HESSE, M., 1873: Mémoire sur des Crustacés rares ou nouveaux des cotes de France (vingt et unième article) Memoire sur la famille des Spheromiens, à l'occasion des affinités et des relations sexuelles qui paraissent exister entre les Spheromiens et les *Cymodocees* d'une part et les *Dynaméniens* et les *Neseens* d'autre part. Ann. Sci. Nat. Zool. Paris. Ser. V, Vol. XVII 1-35.

HOLDICH, D. M., 1968 a: Reproduction, growth and bionomics of *Dynamene bidentata* (Crustacea: Isopoda). Proc. zool. Soc. Lond. **156**, 137-153.

—, 1968 b: The biology of *Dynamene bidentata* (ADAMS) and some related sphaeromid Isopoda. Ph. D. Thesis, University of Wales.

—, 1969: The distribution and habitat preferences of the Afro-European species of *Dynamene* (Crustacea: Iospoda). J. nat. Hist. (In press).

HOLMES, S. 1904: Remarks on the sexes of Sphaeromids with a description of a new species of *Dynamene*. Proc. Calif. Acad. Sci. Ser. 3, Zool. **3**, 1901-4, 295-306.

HOLTHUIS, L. B., 1949: The Isopoda and Tanaidacea of the Netherlands, including a description of a new species of *Limnoria*. Zool. Meded. Leiden **30** (12), 163-190.

—, 1952: Enige interessante, met drijvende voormerpen op de Nederlandse kust aangespoelde zeepissebedden en zeepokken. Levende Natuur **55**, 71-78.

—, 1956: Fauna van Nederland. Isopoden en Tanaidacea (KV), Fauna Nederl. **16**, 1-280.

HOPE, F. G., 1851: Catalogo dei Crostacei italiani e di molti altri del Mediterraneo. Napoli. 48 pp.

KOEHLER, H., 1885: Contribution à l'étude de la fauna littorale des îles anglo-normandes. Ann. Sci. Nat. Zool. Paris, Ser. 6, **20**, 1-54.

LAMOUROUX, J. V. F., 1812: Sur la classification des Polypiers coralligènes non entièrment pierreux. Paris, Soc. Philom. N. Bull. III, 181-188.

LEACH, W. E., 1814: Crustraceology. In Brewster's Edinburgh Encyclopaedia **7**, 383-437. Edinburgh.

—, 1815: A tabular view of the external characters of four classes of animals, which Linné arranged under Insecta. Trans. Linn. Soc. London. **9**, 306-400.

—, 1818: « Cymothoadées » in Dictionnaire des Science Naturelles **12**, 69-75. Paris and Strasburg.

LUCAS, H., 1849: Histoire naturelle des animaux articulés. Exploration scientifique de l'Algérie pendant les années 1840, 1841, 1842. Sciences physiques Zoologie **I**, 1-403. Paris.

MARINE BIOLOGICAL ASSOCIATION, 1906: Plymouth Marine Invertebrate Fauna, 1st ed. J. mar. biol. Ass. U.K. **7**.

—, 1957: Plymouth Marine Fauna, 3rd ed. 457 pp. Plymouth.

MENZIES, R. J., 1961: The zoogeography, ecology, and systematics of the Chilean marine isopods. Repts. Lund Univ. Chile Exp. 1948-9, No. 42. Acta Univ. Lund N.S. Avd. **57** (11), 1-162.

MIERS, E. J., 1876: Descriptions of some new species of Crustacea chiefly from New Zealand. Ann. Mag. Nat. Hist. Ser. 4, **17**, 218-229.

—, 1881: Crustacea, in: Günther, A. Account of the zoological collections made during the survey of H. M. ALERT in the Straits of Magellan and the coast of Patagonia. Proc. zool. Soc. Lond. 1881, 61-80.

MILNE-EDWARDS, M., 1840: Histoire Naturelle des Crustacés comprenant l'anatomie la physiologie et la classification de ces animaux. Librairie Encyclopédique de Roret. **3**, 605 pp. Paris.

MONOD, T., 1923 a: Prodrome d'une Faune des Tanaidacea et des Isopoda (excl. Epicaridea) des Côtes de France (Excl. Mediterranée). Soc. Sci. Nat. Charenteinférieure. **33** (4), 19-125.

—, 1923 b: Faune de l'appontement de l'administration à Port-Etienne. Bull. Soc. Zool. France XLVIII, 313-316.

—, 1932: Tanaidacés et Isopodes aquatiques de l'Afrique occidentale et septentrionale. Pt. 3. Sphaeromatidae. Mem. Soc. Sci. Nat. Maroc **29**, 1-91.

MOORE, H. F., 1902: Reports on Porto Rican Isopoda. Bull. U.S. Fish Commission **20** (2), 173-174.

MORTON, J., 1954: The crevice faunas of the upper intertidal zone at Wembury. J. mar. biol. Ass. U.K. **33**, 187-224.

MORTON, J., and M. MILLER, 1968: The New Zealand Sea Shore. Collins, London and Auckland. 638 pp.

NAYLOR, E., and D. QUÉNISSET, 1964: The habitat and life-history of *Naesa bidentata* (Adams). Crustaceana **7** (3), 212-216.

NIERSTRASZ, H. F., 1931: Die Isopoden der Siboga Expedition. Isopoda Genuina. Results des Explorations Zoologiques, Botaniques, Oceanographique, et Geologique enterprises aux Indes neérlandaises orientales en 1889-1900 sous le commandement de G. F. Tydeman, publiés par Max Weber, Chef de l'expedition. Monogr. **32**c, 123-232.

NORMAN, A. M., 1907: Notes on the Crustacea of the Channel Islands. Ann. Mag. Nat. Hist. **20**, 356-371.

NORMAN, A. M., and T. SCOTT, 1906: The Crustacea of Devon and Cornwall. 232 pp. London

OMER-COOPER, W., 1917: Some rare and interesting local Isopoda. Proc. Bournmouth Nat. Sci. Soc. **8**, 72-81.

OMER-COOPER, J., and J. H. RAWSON, 1934: Notes on the British Sphaeromatidae (Crustacea, Isopoda). Rep. Dove mar. Lab., **3** (2), 22-58.

PARFIT, E., 1874: The fauna of Devon. Pt. IX. Sessile eyed Crustacea. Trans. Devonshire Assn. Adv. Sci. Litt. Art. **6**, 236-260.

PAULI, V. L., 1954: Free living isopods of the Black Sea. Trudy Sevastopol. Biol. Sta. **8**, 100-135.

PYEFINCH, K. A., 1943: The intertidal ecology of Bardsey Island, North Wales, with special reference to the recolonization of rock surfaces and the rock-pool environment. J. Anim. Ecol. **12**, 88-108.

RACOVITZA, E. G., 1908: *Ischyromene lacazei* n. g., n. sp. Isopode méditerranéen de la famille des Sphéromidés (Note préliminaire). Archs Zool. exp. gen., Paris, (4), 9, Notes et Revue **3**, 70-74.

RICHARDSON, H., 1899: Key to the isopods of the Pacific coast of North America with descriptions of twenty-two new species. Proc. U.S. Nat. Mus. **21**, 815-869.

—, 1901: Key to the isopods of the Atlantic coast of North America with descriptions of new or little known species. Proc. U.S. Nat. Mus. **23**, 403-579.

—, 1905: A monograph on the isopods of North America. Bull. U. S. Nat. Mus. No. **54**, 1-727.

ROBERTSON, R., 1890: Contributions towards a catalogue of the Amphipoda and Isopoda of the Firth of Clyde. Trans. Nat. Hist. Soc. Glasgow **2** (2), 1887-88, 9-99.

SAY, T., 1818: An account of the Crustacea of the United States. Jour. Acad. Nat. Sci. Philadelphia **1**, 423-441.

SCOTT, T., 1906: A catalogue of land, fresh-water and marine Crustacea found in the basin of the Firth of Forth and its estuary. Pt. I. Malacostraca, Cladocera, and Branchiura. Proc. Royal Phys. Soc. Edinburgh **16**, 97-199.

SINEL, J., 1906: A contribution to our knowledge of the Channel Islands. Trans. Guernsey Soc. Nat. Sc. 1906, 212-225.

STEBBING, T. R. R., 1874: A New Australian Sphaeromid *Cycluria venosa* and notes on *Dynamene rubra* and *viridis*. J. Linn. Soc. London, Zool. **12** (58), 146-151.

—, 1893: A history of Crustacea. Recent Malacostraca. The International Scientific Series **74**, 361-362. London.

—, 1905 a: Crustaceans. *In* The Victorian History of the County of Sussex, I, 262.

—, 1905 b: Report on the Isopoda collected by Professor Herdmann at Ceylon in 1902. Rept. Pearl Oyster Fisheries of the Gulf of Manaar. Marine biology of Ceylon, Suppl. Rept. **23**, 1-64.

—, 1906 a: Crustaceans. *In* The Victorian History of the County of Cornwall, I, 276.

—, 1906 b: Crustaceans. *In* The Victorian History of the County of Devon, I, 266.

TATTERSALL, W. M., 1905: Marine fauna of the coast of Ireland. Pt. V. Isopoda. Fisheries, Ireland, Sci. Invest. 1904, **2**, 1-90.

—, 1912: Marine Isopoda and Tanaidacea. A biological survey of Clare Island in the county of Mayo, Ireland, and the adjoining district. Sect. 2, Pt. 43. Proc. R. Irish Acad. **31**, 1-6.

TEMPLETON, R., 1936: Catalogue of the Irish Crustacea, Myriapoda and Arachnida selected from the papers of the late John Templeton, Esq. Mag. Nat. Hist. **9**, 9-14.

THOMPSON, D'Arcy W., 1901: A catalogue of Crustacea and Pycnogonida contained in the museum of the University College, Dundee. 56 pp. Dundee.

THOMSON, G. M., 1879: New Zealand Crustacea, with descriptions of new species. Trans. N.Z. Inst. **11**, 230-248.

TINTURIER-HAMELIN, E., 1962: Sur le polychromatisme de l'Isopode Flabellifère *Dynamene bidentata* (ADAMS). I. Premiers resultats d'une étude génetique. C.r. hebd. Séanc. Acad. Sci., Paris **254**, 3906-3908.

—, 1967: Sur le polychromatisme de l'Isopode Flabellifère *Dynamene bidentata* (ADAMS). II. Etude genetique du mutant *bimaculata* partiellement lié au sexe. Archs Zool. exp. gén. **108** (3), 511-520.

TORELLI, B., 1930: Sferomidi del Golfo di Napoli (Revisione degli Sferomidi mediterranei). Pubbl. Staz. Zool. Napoli **10** (3), 297-343.

DE TRISTAN, J., 1809: Memoire sur quelques insectes crustacés trouvés sur les Côtes de Poitou. Ann. Mus. Nat. Hist. Paris **13**, 371-380.

VERHOEFF, K. W., 1942: Sphaeromiden Studien und *Buchnerillo* n. g. Z. Morph. Ökol. der Tierre **39**, 135-175.

WALKER, A. O., 1892: Report on the Higher Crustacea of Liverpool Bay taken in 1889. Repts. Fauna Liverpool Bay (L.M.B.C. Repts.) Liverpool. **3**, 239-251.

—, 1896: List of Crustacea. Malacostraca. In The Marine Zoology, Botany, and Geology of the Irish Sea. Fourth and final report of the committee, etc. Rept. British Assn. Adv. Sci. Liverpool, 417-450.

—, 1898: Malacostraca from the West of Ireland. Proc. Trans. Liverpool Biol. Soc. **12**, 1897-98, 159-172.

WHITE, A., 1847: List of specimens of British animals in the collection of the British Museum. 143 pp. London.

—, 1850: List of the specimens of British animals in the collection of the British Museum. Pt. IV, Crustacea, 1-141. London.

—, 1857: A popular history of the British Crustacea; comprising a familiar account of their classification and habits. 358 pp. London.

WIESER, W., 1952: Investigations on the microfauna inhabiting seaweeds on rocky coasts. IV. Studies on vertical distribution of the fauna inhabiting seaweeds below the Plymouth laboratory. J. mar. biol. Ass. U.K. **31**, 145-174.

—, 1962: Adaptations of two intertidal isopods. I. Respiration and feeding in *Naesa bidentata* (ADAMS) (SPHAEROMATIDAE). J. mar. biol. Ass. U.K. **42**, 665-682.

—, 1963: Adaptation of two intertidal isopods. II. Comparison between *Campecopea hirsuta* and *Naesa bidentata* (SPHAEROMATIDAE). J. mar. biol. Ass. U.K. **43**, 97-112.

YONGE, M. W., 1927: Marine fauna of the Chatham Islands. Trans. N.Z. Inst. **60**, 136-166.

Dr. D. M. HOLDICH, Department of Zoology, The University, Nottingham, U.K.