

**On Copepoda associated with Dutch molluscs <sup>1)</sup>**

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It is known for more than a century already that molluscs are appropriate hosts for Copepoda. Since we are in many cases uncertain what relation exactly exists between the mollusc and the copepod, terms like "parasite", "semi-parasite" and "commensal" can better be avoided and the more neutral term "associate" used instead. MONOD & DOLLFUS summarized in 1932 all previous literature on copepods associated with molluscs. HUMES estimated in 1958 the number of copepods known to live on or in molluscs, at over 100 species, divided over about 60 genera. These copepods do not form a systematic unity, but belong to different groups; the greater part of them have been classified with the Cyclopoida, although all other copepod orders, with the exception of the Calanoida, include associated forms. In the last few years several dozens of new species have been described, the total number of copepods associated with molluscs being therefore may be 50% higher than HUMES' estimate.

The hosts belong to the classes Gastropoda, Cephalopoda and Lamellibranchia; from the Monoplacophora, Amphineura and Scaphopoda no copepods became known hitherto. All hosts are marine, except for one case of infection of an African brackish water *Congeria* (cf. HARDING, 1963).

<sup>1)</sup> This paper is respectfully dedicated to Mrs. W. S. S. van der Feen-van Benthem Jutting on the occasion of her 65th anniversary.

One can find among these associates every transition from forms hardly adapted to the special mode of life (often considered only as "messmates" or "commensals") to fully and unrecognizably transformed animals, real internal parasites. For instance, *Teredoika serpentina* Stock, 1959, living in the stomach of *Teredo utriculus* Gm. from the Gulf of Naples, has lost all appendages; this species is recognizable only as a copepod from the less modified larval stages.

Since some species cause damage to commercially important molluscs, the study of these associates is not devoid of economic interest. The enormous damage caused by *Mytilicola intestinalis* Steuer, 1902, during the last 14 years to mussel cultures in western Europe, might in this context be brought in mind.

Although our Dutch malacofauna certainly cannot be called a poor one, the total number of copepods known to be associated with molluscs in our faunal region is very limited (compare table I). In contrast with this, table II lists the autochthonous Dutch molluscs — as far as they are parasitized — with their characteristic associated copepods, based on observations made outside the Netherlands. From table II it is evident that much faunistic research in this field is still necessary in our area. As standard for the autochthonous occurrence of the molluscs listed in the tables, I relied upon data published by VAN BENTHEM JUTTING (1933 and 1943), BLOKLANDER (1952) and SWENNEN (1961). It may be repeated that only those mollusc-species, from which associates are known in extraterritorial waters, have been included in table II.

Table I. Autochthonous molluscs with their associated copepods known from Dutch waters

Host	Associated copepod	Authority
<i>Aeolisia papillosa</i> (L.), dorsal papillae	<i>Denticola</i> (or <i>Lichomolgus</i> ) <i>agilis</i> Leydig, 1853	Stock, 1952
<i>Sepia officinalis</i> L., gills	<i>Lichomolgus longicauda</i> (Claus, 1860)	Stock, 1956
<i>Mytilus edulis</i> L., gills	<i>Modiolicola insignis</i> Aurivillius, 1882	Stock, 1950; Koringa, 1951; Stock & de Vos, 1960
the same, intestines	<i>Mytilicola intestinalis</i> Senefer, 1902	Koringa, 1950 and several later publications
<i>Ostrea edulis</i> L., gut	<i>Mytilicola intestinalis</i> Senefer, 1902	unpublished (Zeeland)
<i>Cardium edule</i> L., pallial cavity	<i>Paranthessius</i> ( <i>Herrmannella</i> ) <i>rostratus</i> (Cann, 1891)	Stock, 1950; De Vos & Stock, 1960
<i>Venus gallina striatula</i> (Da C.), pallial cavity	<i>Lepinogaster</i> spec.	unpublished (IJmuiden, Noorderstrand)
<i>Venerupis pullastra</i> (Mont.), pallial cavity	<i>Paranthessius</i> (H.) <i>rostratus</i> (Cann, 1891)	unpublished (Texelstrom)
<i>Spisula subtruncata</i> (Da C.), pallial cavity	<i>Paranthessius</i> (H.) <i>rostratus</i> (Cann, 1891)	Stock, 1959
<i>Abra alba</i> (W. Wood), pallial cavity	<i>Lepinogaster bistrio</i> (Pelenceer, 1929)	Bocquet & Stock, 1958
<i>Macoma balthica</i> (L.), pallial cavity	<i>Lepinogaster bistrio</i> (Pelenceer, 1929)	Bocquet & Stock, 1958; Stock & de Vos, 1960
the same, pallial cavity	<i>Paranthessius</i> (H.) <i>rostratus</i> (Cann, 1891)	Stock, 1959

Table II. Autochthonous molluscs with their associated copepods known from foreign waters

Host	Associated copepod	Distribution of the associate in the host mentioned
Class GASTROPODA		
<i>Calliostoma zxyppinum conuloide</i> (Lam.), rectal gland	<i>Endocheeres obscurus</i> Bocquet & Stock, 1956	Brittanny
the same, rectum	<i>Trochicola entericus</i> Dollfus, 1914	Normandy
<i>Odotostoma scalaris</i> (Macgillivray), pallial cavity	<i>Monstrilla belgolandica</i> Claus, 1863	Boulonnais
<i>Crepidula fornicata</i> (L.), gut	<i>Mytilicola intestinalis</i> Steener, 1902	England (experimental infection)
the same, gut	<i>Mytilicola orientalis</i> Mori, 1935	California
<i>Buccinum undatum</i> L., body surface	<i>Anthessius teissieri</i> Bocquet & Stock, 1958	Channel coast of France
<i>Archidoris tuberculata</i> (Cuvier), gills	<i>Doridicola agilis</i> Leydig, 1853	European coasts from Sweden to the Mediterranean
the same, coelom	<i>Splanchnotrochus</i> spec.	Arcachon
<i>Joronna tomentosa</i> (Cuvier), gills	<i>Doridicola agilis</i> Leydig, 1853	Boulonnais
<i>Acanthodoris pilosa</i> (Abildg. in Müll.), coelom	<i>Splanchnotrochus gracilis</i> Hancock & Norman, 1863	England
<i>Ancula cristata</i> (Alder), coelom	<i>S. willemi</i> Canu, 1891	Atlantic coast of France
<i>Doto coronata</i> (Gmelin), coelom	<i>S. brevispes</i> Hancock & Norman, 1863	England
the same, dorsal papillae	<i>Doridicola agilis</i> Leydig, 1853	No locality (Pelseener, 1928)
<i>Coryphella verrucosa</i> (M. Sars), coelom	<i>Splanchnotrochus brevispes</i> Hancock & Norman, 1863	England
<i>Facelina coronata</i> (Forbes & Goodsir), coelom	<i>S. willemi</i> Canu, 1891	Atlantic coast of France
the same, dorsal papillae	<i>Doridicola agilis</i> Leydig, 1853	Roussillon, Atlantic coast of France, Norway
<i>Antipella cristata</i> (D.Ch.), dorsal papillae	<i>Doridicola agilis</i> Leydig, 1853	England, Atlantic coast of France
<i>Aeolidiella glauca</i> (Alder & Hancock), coelom	<i>Splanchnotrochus angulatus</i> Hecht, 1893	Brittanny
<i>Aeolidia papillosa</i> (L.), coelom	<i>Splanchnotrochus angulatus</i> Hecht, 1893	Brittanny

Host	Associated copepod	Distribution of the associate in the host mentioned
<b>Class CEPHALOPODA</b>		
<i>Eledone moschata</i> (Lam), gills	? <i>Penella varians</i> Stp. & Lütken, 1861	Adriatic Sea
<i>Loligo vulgaris</i> Lam., gills	? <i>Penella varians</i> Stp. & Lütken, 1861	Adriatic Sea
<i>Ommatostrephes sagittatus</i> (Lam.), gills	<i>Doridicola</i> ? <i>agilis</i> Leydig, 1853	Costa Brava
<i>Octopus vulgaris</i> Lam., body surface	<i>Doridicola s. superbus</i> Humes, 1957	Banyuls, Brittany
<b>Class LAMELLIBRANCHIA</b>		
<i>Modiolus modiolus</i> (L.), gills	<i>Modiolicola insignis</i> Aurivillius, 1882	North Sea Region
<i>Mytilus edulis</i> L., pallial cavity	<i>Trobe celata</i> Humes, 1954	New Brunswick
the same, gut	<i>Pseudomyicola spinosus</i> (Raff. & Montic., 1885)	Mediterranean
the same, intestines	<i>Mytilicola orientalis</i> Mori, 1935	California
<i>Pecten maximus</i> (L.), pallial cavity	<i>Parantheissius maximus</i> (Thompson, 1893)	England
<i>Chlamys varia</i> (L.), pallial cavity	<i>Parantheissius (Herrmannella) pectinis</i> (Pesta, 1909)	Brittany, England
<i>Chlamys opercularis</i> (L.), pallial cavity	<i>Parantheissius (H.) pectinis</i> (Pesta, 1909)	Atlantic coast of France
the same, pallial cavity	<i>Parantheissius inermis</i> (Canu, 1891)	Atlantic coast of France
the same, rectum	<i>Trochicola pectinidarum</i> Tuzet & Ormières, 1961	Sète (S. France)
<i>Ostrea edulis</i> L., gills	<i>Parantheissius (Herrmannella) ? barneae</i> (Pelseener, 1929)	French Channel coast
<i>Laevicardium crassum</i> (Gmelin), gills, in galls	<i>Lichomolgus leptodermatus</i> Gooding, 1957	English and French Channel coasts
the same, pallial cavity	<i>Parantheissius (H.) haploceras</i> Bocquet & Stock, 1959	England, Brittany
<i>Cardium edule</i> L., gut	<i>Mytilicola intestinalis</i> Steuer, 1902	England
<i>Cardium echinatum</i> L., pallial cavity	<i>Conchyliurus cardii cardii</i> Gooding, 1957	English and French Channel coasts
<i>Dosinia exoleta</i> (L.), gut	<i>Mytilicola intestinalis</i> Steuer, 1902	Brittany
the same, gills	<i>Anthessius arenicolus</i> (Brady, 1872)	Brittany

Host	Associated copepod	Distribution of the associate in the host mentioned
<i>Venerupis pullastra</i> (Mont.), pallial cavity	<i>Conchyliurus cardii tapetis</i> Bocquet & Stock, 1958	Brittany
the same, gut	<i>Mytilicola inestetinalis</i> Steuer, 1902	England, experimental infection
<i>Spisula solidula</i> (L.), pallial cavity	<i>Paramphibessius</i> ( <i>Herrmannella</i> ) <i>rostratus</i> (Canu, 1891)	Brittany
<i>Maestra corallina cinerea</i> Mont., pallial cavity	<i>Paramphibessius</i> (H.) <i>rostratus</i> (Canu, 1891)	French Channel coast
<i>Lustraria lutraria</i> (L.), pallial cavity	<i>Paramphibessius</i> (H.) <i>rostratus</i> (Canu, 1891)	Brittany
<i>Solen marginatus</i> Mont., pallial cavity	<i>Paramphibessius</i> (H.) <i>rostratus</i> (Canu, 1891)	Brittany
the same, pallial cavity	<i>Conchyliurus solensis</i> Bocquet & Stock, 1957	Brittany
<i>Ensis siliqua</i> (L.), pallial cavity	<i>Anthebessius minor</i> Stock, 1959	Naples
the same, pallial cavity	<i>Paramphibessius</i> (H.) <i>rostratus</i> (Canu, 1891)	Brittany
<i>Mya arenaria</i> L., pallial cavity	<i>Mytilicola metisienis</i> Wright, 1885	Atlantic coast of U.S.A.
the same, pallial cavity	<i>Lepinogaster major</i> (Williams, 1907)	Atlantic coast of U.S.A.
<i>Barnes candida</i> (L.), pallial cavity	<i>Paramphibessius</i> ( <i>Herrmannella</i> ) <i>barnese</i> (Pelseneer, 1929)	Boulonnais
<i>Pobas dactylus</i> L., pallial cavity	<i>Paramphibessius</i> (H.) <i>barnese</i> (Pelseneer, 1929)	Brittany
the same, pallial cavity	<i>Lepinogaster pholadis</i> Pelseneer, 1929	Naples, Brittany

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