

ICES IDENTIFICATION LEAFLETS FOR DISEASES AND PARASITES OF FISH AND SHELLFISH

LEAFLET NO. 24

FEBRUARY 2016

Mytilicola intestinalis, parasitism

Original by V. Dethlefsen
Revised and updated by John P. Bignell



ICES

International Council for
the Exploration of the Sea

CIEM

Conseil International pour
l'Exploration de la Mer

International Council for the Exploration of the Sea Conseil International pour l'Exploration de la Mer

H. C. Andersens Boulevard 44–46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

Recommended format for purposes of citation:

Original by V. Dethlefsen

Revised and updated by John P. Bignell. 2016. *Mytilicola intestinalis*, parasitism. ICES Identification Leaflets for Diseases and Parasites of Fish and Shellfish. Leaflet No. 24 (revised). 7 pp.

Series Editor: Stephen Feist. Prepared under the auspices of the ICES Working Group on Pathology and Diseases of Marine Organisms.

The material in this report may be reused for non-commercial purposes using the recommended citation. ICES may only grant usage rights of information, data, images, graphs, etc. of which it has ownership. For other third-party material cited in this report, you must contact the original copyright holder for permission. For citation of datasets or use of data to be included in other databases, please refer to the latest ICES data policy on the ICES website. All extracts must be acknowledged. For other reproduction requests please contact the General Secretary.

<https://doi.org/10.17895/ices.pub.5196>

ISBN 978-87-7482-181-6

ISSN 0109–2510

© 2016 International Council for the Exploration of the Sea

Contents

Susceptible species.....	1
Disease name.....	1
Aetiological agent.....	1
Geographical distribution.....	1
Significance.....	1
Associated environmental conditions.....	2
Gross clinical signs.....	2
Control measures and legislation.....	2
Diagnostic methods.....	2
Key References.....	3
Author Contact Information.....	7

Mytilicola intestinalis, parasitism

Original by V. Dethlefsen

Revised and updated by John P. Bignell

Susceptible species

Mytilicola intestinalis primarily affects the marine mussels *Mytilus edulis* and *M. gallprovincialis*. *M. intestinalis* has also been shown to affect *Ostrea edulis* and *Crassostrea gigas* in both field and laboratory studies (Baird, R.H. *et al.*, 1951; Dare, 1982; Aguirre-Macedo, M. L., and Kennedy, C. R. 1999).

Disease name

Mytilicola intestinalis (Steuer, 1902; Steuer, 1905), parasitism, red worm disease, cop rouge.

Aetiological agent

M. intestinalis is a parasitic copepod belonging to the family Mytilicolidae and similar in appearance to the *M. orientalis*. The planktonic phase lasts three to four days, the larvae then descend to bottom; total free-living stage is 10 to 14 days; breeding and reproductive cycles depend on the geographic distribution. Two complete breeding cycles with two generations are observed; recruitment takes place in summer and autumn; there are seasonal cycles in sex ratio and abundance at some places; in the Mediterranean there are no seasonal cycles.

Geographical distribution

M. intestinalis is primarily found in the Mediterranean Sea, North Sea, and other coastal regions of the North East Atlantic (including the United Kingdom and Ireland) from Spain to and inclusive of Denmark. The widespread distribution within the North East Atlantic region is believed to originate from the transferral of *M. gallprovincialis* on the hull of shipping from the Mediterranean (Minchin, 1996). Whilst this parasite has not officially been reported within the Baltic Sea, an unidentified parasitic larval copepod was reported in mussels sampled from the northern Baltic (Gilek *et al.*, 1992). Outside of this geographical distribution, *M. intestinalis* has been found in the Indian Ocean–Malacca Strait (Wickstead, 1960).

Significance

Mixed evidence exists within the literature concerning the impact of *M. intestinalis* on their molluscan host. Previous reports suggest *M. intestinalis* is capable of decreasing the general condition of the host (Thiesen, 1987) in addition to causing significant mortalities (Lauckner, 1983). Reports elsewhere suggest this is not true in all cases (Dethlefsen, 1975; Davey, 1989). Moreover, factors including, host size, reproduction and seasonal cycles are all more likely to affect the condition than parasitism with *M. intestinalis* in isolation (Gee *et al.*, 1977).

Associated environmental conditions

The mixed reports concerning the impact of *M. intestinalis* on their host suggests that other factors may play a role in the ability for parasitism to elicit adverse effects e.g. environmental conditions.

Gross clinical signs

Host species do not exhibit gross clinical signs, although adult *M. intestinalis* are readily observed in the dissected stomach and intestinal tract of infected hosts.

Control measures and legislation

Parasitism with *M. intestinalis* is primarily dictated by survival of the planktonic stage (Figure 1: third planktonic stage) and the ability to locate a suitable bivalve host (Davey *et al.*, 1978). Gee and Davey (1986) demonstrated this to be largely influenced by the host's field of filtration and the strength of the inhalant current. Other factors that can influence the infestation and spread of *M. intestinalis* include the age and density of larval population; host population size and density; wave action, current speed, turbulence and water depth; and, temperature and salinity (Paul, 1983; Davey and Gee, 1976; Robledo *et al.*, 1994; Fuentes *et al.*, 1998; Rayyan *et al.*, 2004). Parasitism and spread of *M. intestinalis* is reportedly reduced by restricting mussel density and avoiding sheltered coastal areas where wave action and currents are reduced (Andreu, 1963; Brienne, 1964).

Parasitism with *M. intestinalis* is not reportable to the World Organisation for Animal Health (OIE).

Diagnostic methods

Gross observations

Adult *M. intestinalis* are readily observed in the dissected stomach and intestinal tract of infected hosts. Their vivid red-brown colouration aids their identification without the requirement for a compound dissecting microscope. Individual copepods may be carefully removed from dissected mussels with the aid of forceps, prior to identification. Chemical digestion of tissues using pepsin, followed by filtration, can be used to reveal more cryptic individuals that may not be removed via mechanical methods.

In the adults, the body is elongated and worm-like, and has thoracic segments with paired dorsal processes. Segmentation of the abdomen is incomplete. The head carries a median eye; the first antennae have four joints, the second have three, and the last are forming a hook. Females frequently have paired egg sacs at the posterior end of the body. Subadults are frequent in direct intestine and first recurrent intestine. Juveniles occur in ramifications of digestive gland. Individuals may be misidentified with *M. orientalis*, although several morphological differences exist: (a) the caudal ramus of *M. intestinalis* and *M. orientalis* are both elongated although it is more divergent in *M. intestinalis*; (b) the second antenna has three segments (podomeres) in *M. intestinalis* compared to two in *M. orientalis*; (c) female *M. intestinalis* are generally shorter than female *M. orientalis* (Bower, 1994).

Sizes in the different stages of the *M. intestinalis* life cycle: the planktonic stages: 1) nauplius, 0.20 mm; 2) metanauplius, 0.25–0.26 mm, 6 segments; 3) first copepodid (cyclopoid), 0.40 mm; and the parasitic stages: 1) second copepodid, 0.48 mm, very similar to third planktonic stage (Figure 1); 2) third copepodid, 0.49–0.52 mm (Figure 2); 3) subadults, 1.5–1.7 mm (Figures 3 and 4); 4) adults, 4.0–8.0 mm (Figure 5).

Histology

M. intestinalis can be seen in histological cross sections located in the stomach and intestinal tract of affected animals. It is not unusual to observe several copepods within one host. Individual copepods may be seen attached to the stomach or intestinal epithelium through the use of hook-like appendages (Figures 6 to 9). These attachments can result in metaplastic changes including replacement of ciliated columnar cells by non-ciliated cuboidal cells (Moore *et al.*, 1978). Although not typical, a marked haemocytic response may be observed if individual copepods breach the epithelium through to the vesicular connective tissue (Bignell, unpublished).

Key References

- Aguirre-Macedo, M. L., and Kennedy, C. R. 1999. Diversity of metazoan parasites of the introduced oyster species *Crassostrea gigas* in the Exe estuary. *Journal of the Marine Biological Association of the United Kingdom*, 79(01): 57–63.
- Andreu, B. 1963. Propagación del copépodo parásito *Mytilicola intestinalis* en el mejillón cultivado de las rías gallegas (NW de España). *Investigación Pesquera*, 24: 3–20.
- Baird, R. H., Bolster, G. C., and Cole, H. A. 1951. *Mytilicola intestinalis*, Steuer, in the European flat oyster (*Ostrea edulis*). *Nature*, 168: 560.
- Bower, S. M., McGladdery, S. E., and Price, I. M. 1994. Synopsis of infectious diseases and parasites of commercially exploited shellfish. *Annual Review of Fish Diseases*, 4: 1–199.
- Brienne, H. 1964. Observations sur l'infestation des moules du Pertuis Breton par *Mytilicola intestinalis* Steuer. *Revue des Travaux de l'Institut des Pêches Maritimes*, 28: 205–230.
- Dare, P. J. 1982. The susceptibility of seed oysters of *Ostrea edulis* L. and *Crassostrea gigas* Thunberg to natural infestation by the copepod *Mytilicola intestinalis* Steuer. *Aquaculture*, 26(3): 201–211.
- Davey, J. T. 1989. *Mytilicola intestinalis* (Copepoda: Cyclopoida): a ten-year survey of infested mussels in a Cornish estuary, 1978–1988. *Journal of the Marine Biological Association of the United Kingdom*, 69: 823–836.
- Davey, J. T., and Gee, J. M. 1976. The occurrence of *Mytilicola intestinalis* Steuer, an intestinal copepod parasite of *Mytilus*, in the south-west of England. *Journal of the Marine Biological Association of the United Kingdom*, 56(01): 85–94.
- Dethlefsen, V. 1975. The influence of *Mytilicola intestinalis* Steuer on the meat content of the mussel *Mytilus edulis* L. *Aquaculture*, 6(1): 83–97.
- Fuentes, J., Villalba, A., Zapata, C., and Alvarez, G. 1995. Effects of stock and culture environment on infections by *Marteilia refringens* and *Mytilicola intestinalis* in the mussel *Mytilus galloprovincialis* cultured in Galicia (NW Spain). *Diseases of Aquatic Organisms*, 21(3): 221–226.
- Gee, J. M., and Davey, J. T. 1986. Experimental studies on the infestation of *Mytilus edulis* (L.) by *Mytilicola intestinalis* Steuer (Copepoda, Cyclopoida). *Journal du Conseil*, 42(3): 265–271.
- Gee, J. M., Maddock, L., and Davey, J. T. 1977. The relationship between infestation by *Mytilicola intestinalis*, Steuer (Copepoda, Cyclopoidea) and the condition index of *Mytilus edulis* in south-west England. *Journal du Conseil*, 37(3): 300–308.
- Gilek, M., Tedengren, M., and Kautsky, N. 1992. Physiological performance and general histology of the blue mussel, *Mytilus edulis* L., from the Baltic and North Seas. *Netherlands Journal of Sea Research*, 30: 11–21.
- Aguirre-Macedo, M. L., and Kennedy, C. R. 1999. Diversity of metazoan parasites of the introduced oyster species *Crassostrea gigas* in the Exe Estuary. *Journal of the Marine Biological Association of the United Kingdom*, 79(1): 57–63.

- Lauckner, G. 1983. Diseases of Mollusca: Bivalvia. *In* Diseases of Marine Animals, Introduction Bivalvia to Scaphopoda, vol. 2. O. Kinne (Ed.) Biologische Anstalt Helgoland, Hamburg, 477–961.
- Minchin, D. 1996. Management of the introduction and transfer of marine molluscs. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 6: 229–244.
- Moore, M. N., Lowe, D. M., and Gee, J. M. 1978. Histopathological effects induced in *Mytilus edulis* by *Mytilicola intestinalis* and the histochemistry of the copepod intestinal cells. *Journal du Conseil*, 38(1): 6–11.
- Paul, J. D. 1983. The incidence and effects of *Mytilicola intestinalis* in *Mytilus edulis* from the Rías of Galicia, North West Spain. *Aquaculture*, 31(1): 1–10.
- Rayyan, A., Photis, G., and Chintiroglou, C. C. 2004. Metazoan parasite species in cultured mussel *Mytilus galloprovincialis* in the Thermaikos Gulf (North Aegean Sea, Greece). *Diseases of Aquatic Organisms*, 58(1): 55–62.
- Robledo, J. A. F., Santarém, M. M., and Figueras, A. 1994. Parasite loads of rafted blue mussels (*Mytilus galloprovincialis*) in Spain with special reference to the copepod, *Mytilicola intestinalis*. *Aquaculture*, 127(4): 287–302.
- Steuer, A. 1902. *Mytilicola intestinalis* n. gen. n. sp. aus dem Darne von *Mytilus galloprovincialis* Lam. *Zoologischer Anzeiger*, 25: 635–637.
- Steuer, A. 1905. *Mytilicola intestinalis* n. gen. n. sp. *Arbeiten aus dem Zoologischen Institut der Universität Wien und der Zoologischen Station in Triest*, 15: 1–46.
- Theisen, B. F. 1987. *Mytilicola intestinalis* Steuer and the condition of its host *Mytilus edulis* L. *Ophelia*, 27(2): 77–86.
- Wickstead, J. 1960. A new record of *Mytilicola intestinalis* Steuer, a parasitic copepod of mussels. *Nature*, 185: 258.

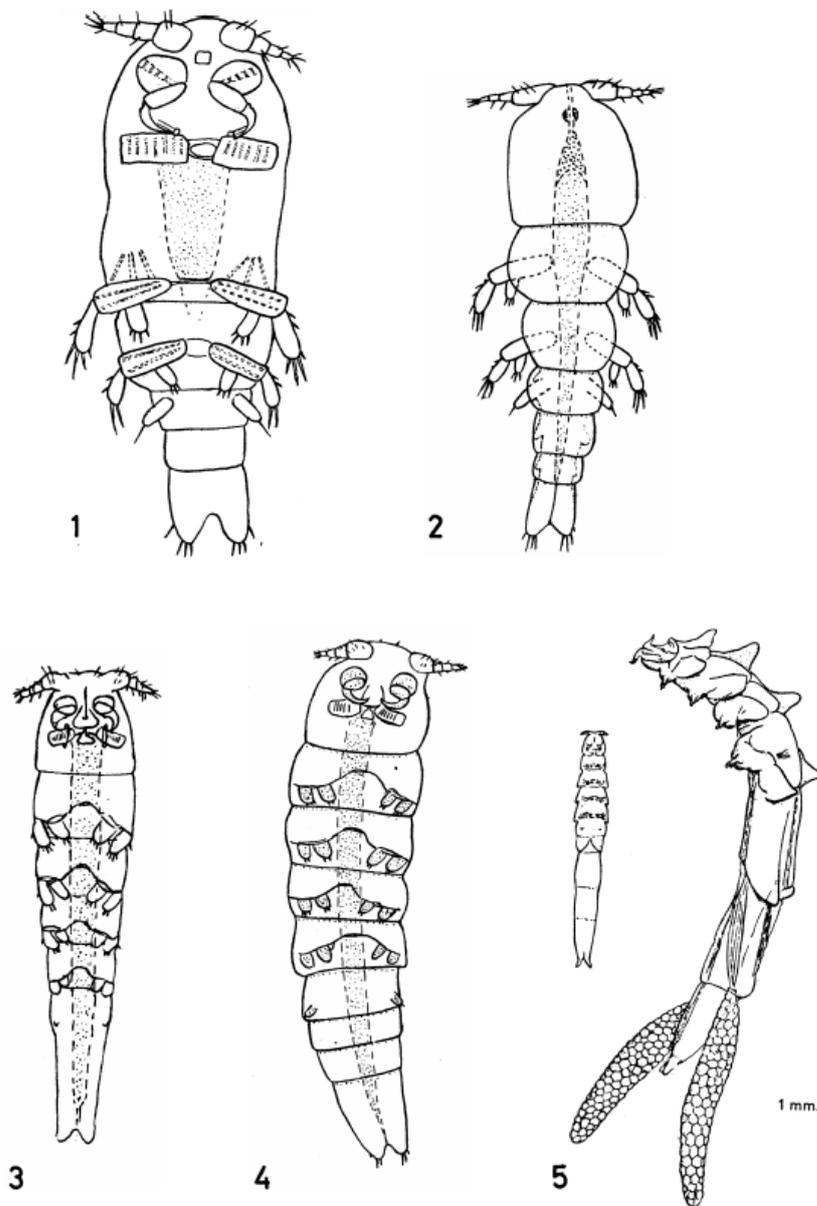


Figure 1. *M. intestinalis*, first parasitic stage, ventral view.

Figure 2. *M. intestinalis*, second parasitic stage, dorsal view.

Figure 3. *M. intestinalis*, third parasitic stage.

Figure 4. *M. intestinalis*, oldest parasitic stage, 1.5 mm.

Figure 5. *M. intestinalis*, adult male (left) and female (right).

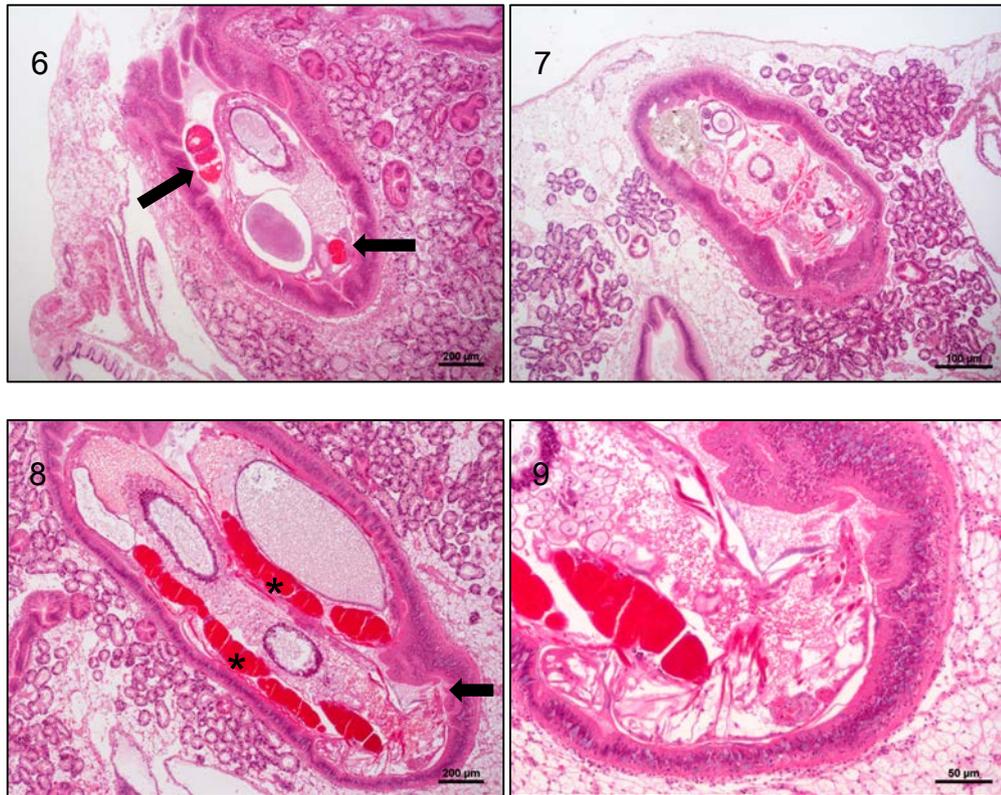


Figure 6. Individual female *M. intestinalis* located within intestinal tract. Note the presence of eosinophilic egg sacks (arrow). Scale bar 200 μm .

Figure 7. Four *M. intestinalis* simultaneously affecting the intestinal tract. The presence of several copepods with an individual host is commonly observed. Scale bar 100 μm .

Figure 8. Two female *M. intestinalis* located within the intestinal tract. The eosinophilic egg sacks can clearly be seen (*). Note the presence of large hook-like appendage attached to gut epithelium (arrow). Scale bar 200 μm .

Figure 9. High magnification image of hook-like appendage shown in Figure 7. Scale bar 50 μm .

Author Contact Information

John Paul Bignell

Cefas

Barrack Road

The Nothe

Weymouth

Dorset

DT4 8UB

United Kingdom

john.bignell@cefas.co.uk