International Council for the
Exploration of the Sea.

C.M.1954
Special Scientific Meeting
"Oyster and Mussel Culture".
No.17.

The Influence of Mytilicola intestinalis (Copepoda parasitica) on the Development of the Gonades of Mytilis edulis.

Hans Mann

THÜNEN
Digitalization sponsored
by Thünen-Institut

I. Introduction and Problems.

Since several years the stocks of Mytilus edulis in northwest Europe are infected by the parasitic copepod Mytilicola intestinalis. The infestation comprises nearly all larger natural and cultivated mussel beds along the Atlantic and North Sea coasts. Physiological investigations (5) proved that the damage made by Mytilicola intestinalis is very great. It affects predominantly the metabolism of the mussels. The result is a deficient development and a decreased meat substance with the infected mussels. Moreover, it had to be expected that the parasites would even affect the development of the gonades. In order to examine this problem, the investigations on the development of the Mytilicola disease carried out in 1951-1953 included equally the observations of the development of the gonades.

The sexes of Mytilus edulis are separated. The gonades of the two sexes consists of a complicated system passing through the whole body, penetrating with well developed animals even the connective tissues between the other organs, covering the intermediary intestinal gland. In the mature stade they occupy a large part of the mantle which can be then considerably thick (2). When reaching sexual maturity, the mantle of the female is of a pink to reddish coloration, whereas the gonads of the male are yellowish or amber- to orange-coloured. With the immature animals the mantle is extremely thinner and of lighter colour, with the female nearly white and with the male light yellow. In spent condition the mantle is transparent, keeping, however, at first the intensor coloration of full maturity, passing gradually into a lighter shade.

The Spawning maturity begins in our latitude at the end of March and lasts, depending on the temperature of the water, until beginning of June. According to the observations made by Chipperfield (1), the maturing process does not seem to depend on the occurrence of food and it begins probably at a water temperature of 7° C. The expulsion of the sperm begins, when the seawater flowing into the mussels has reached a temperature of 9,5 - 12,5° C. Under favourable conditions there can possibly exist ripe eggs at the beginning of March. Ripe sexual products occur always throughout the summer. Havinga (3) suggests that the period during which the sexual products are developed, is divided into two or three main periods. The reproduction of the gonades begins usually 2-3 months after the swarming.

II. Method of Investigation.

Since it was impossible to separate the entire gonades from the body without loss, we confined our work to only separating the whole mantle with the gonades from the mussels. The two halves of the mantle were slightly dried by blotting-paper and then weighed in fresh condition. Simultaneously the length, the total weight and the weight of the meat-portion of each mussel were recorded. As now the weight of the meat-portion and the weight of the gonades were known, the weight of the gonades could be brought into relation of the total weight of the meat-portion. In the course of our investigations on the Mytilicola disease, mussels of all sizes from nearly all the mussel beds of the German North Sea coast had been examined during varying seasons of the year in 1950-53.

III. Results.

In order to obtain an exact idea of the development of the gonades affected by the parasites, we examined at first larger quantities of mussels from an area which was, as we knew by experience, only slightly infested. Here it was quite certain that a sufficient amount of infested and non-infested mussels existed in equal

quantities. We considered the mussel-beds off Cuxhaven suitable for the experiment. Our investigations (5, 6, 8) indicated that mussels from Cuxhaven contained 1-2 parasites each in the average. 40-50 infested and non-infested mussels from the same area were examined each month. The results showed clearly that the gonades of the infested mussels had always a lesser weight than those of the non-infected animals. The underweights fluctuated from 10 to 20%.

In the Wadden Sea off Cuxhaven the mussels were attacked by 2 to 4 parasites per animal. Therefore, it would have been interesting to compare this area with another one, where the mussels were more heavily infested. For that purpose, mussels from Wilhelmshaven were available, where the mussels were infested by 8 parasites and more. The gonades of the infested mussels were equally lesser in weight than those of the non-infested mussels, but the difference in weight was here even more obvious than in the Cuxhaven area; the gonades of the infested mussels were in the average more than 20% lighter in weight than in the sound animals. The fluctuating weight of the gonades in the individual months depends on the varying degree of maturity of the gonades. Another proof for the underweight of the gonades with infested mussels was found by infection-experiments. Under the investigation program on the epidemic effect of Mytilicola intestinalis (7) several experiments were made with tanks, where the development of the gonades could equally be observed. We transplanted sound mussels which were free from Mytilicola from the Wadden areas off Wyk/Föhr to Wilhelmshaven and exposed them there to the neighbourhood of heavily infected animals. A number of the mussels from Wyk were put into tinplate tanks, another number was marked with white paint and then put between the indigenous mussels. The experiments were initiated in June 1951. The examination of the mussels was made from 10th to 13th October, i.e. after 4 months. The weight of the gonades of the non-infested mussels from Wilhelmshaven amounted in the average to 16.7%, that of the infested mussels in the tanks (mussels from Wyk) to 12,6% (2,3 parasites per mussel). For reasons which we were not able to recognize, the freely exposed marked mussels had not been attacked by Mytilicola and their gonades had a weight of 15,8%. The gonades of heavily infested indigenous mussels (10 Parasites per mussel) which we examined simultaneously, showed a weight of 11,5%. This experiment too shows exactly that the gonades are detoriating by the attack of Mytilicola. As the mussel develops a large quantity of gonades, it is not suggested that the mussel beds are seriously endangered by the Mytilicola disease. However, the underdevelopment of the gonades of the attacked animals is another proof for the physiological damage caused by the parasitic copepod.

The microscopical investigation of the gonades indicated another interesting fact. On some gonades we found parasitic Trematods. The weight of these gonades showed that there too a damage had taken place. The weight of these gonades in percentage figures of the meat-weight were:

Date	without parasites	with parasites	Place
22.2.1951	17.2	15,0	Cuxhaven
10.2.1951	16,9	15.3	Wyk/Föhr

IV. Summary.

The weight of the gonades of mussels with and without Mytilicola intestinalis had been investigated and brought into relation to the weight of the meat portion of the mussels. The weight of the gonades of infested mussels does not depend on seasonal fluctuations and is 10 to 30% less than those of non-infested mussels. A similar damage occurs when the gonades are attacked by Trematods.

Area of Investigation: Cuxhaven.

Time	Average number of parasites per mussel, if infested	Weight of the gonades in % of the meat-weight		under-weight in %.
		infested mussel	Non-infested mussel	
7.1.1952	2,4	15,7	19,7	20,0
10.1	2,2	7,0	8,5	17,6
22.2	3,0	11,5	17,2	33,1
15.3	1,5	10,5	17,5	40,3
21.3	4,0	6,9	8,4	17,9
16.4	3,0	14,9	15,5	3,8
18.4	2,0	11,6	14,2	18,3
26.6	7.6	16.6	20.1	17.4
16.8	4,0	11,6	14,3	18,9
5.11	2,3	6,5	7,2	9,7
5.12	1.9	10,6	12,0	11,7

Area of Investigation: Wilhelmshaven.

17.3.1952	6,5	7,7	11,1	30,6
19.4	10,9	9,2	15,0	38,7
7.5	9,7	15,4	19,5	26,2
26.5	8,0	12,8	18,9	31,8
6.6	8,7	8,4	10,1	16,9
7.7	5,8	9,8	13,0	24,6
1.8	2,6	11,6	14,3	18,9
10.10	10,0	11,5	16,7	31,1

Literature

1. CHIPPERFIELD, P.N.J. 1953 "Observations on the breeding and settlement of Mytilus edulis (L.) in British waters." J.Mar.Biol.Ass.U.K.32.449-476.

2. FIELD, J.A. "Biology and economic value of the sea mussel Mytilus edulis". Bull.U.S.Bur.Fish.vol.38,127-259, 1922.

3. HAVINGA, B. "Krebse und Weichtiere." Hdbch.d.Seefischerei Nordeuropas.Bd.III,2.Stuttgart,1929.

4. MANN, H. "Qualitätsverminderung des Fleisches der Miesmuscheln durch den Befall mit Mytilicola intestinalis." Fischereiwelt 1951.

5. MEYER, P.F. & MANN, H. "Beiträge zur Epidemiologie und Physiologie des parasitischen Copepoden Mytilicola intestinalis." Arch.f.Fischereiw. 2. 119-134, 1950.

6. MEYER, P.F. & MANN, H. "Mytilicola - Epedemie 1951/52." Fischwirtschaft 1952.

7. MEYER, P.F. & MANN, H. "Ein weiterer Beitrag zur Epedemiologie von Mytilicola intestinalis." Arch.f.Fischereiwiss.5.26-34.1954.

8. MEYER, P.F. & MANN, H. "Der Befall von Mytilus edulis mit Mytilicola intestinalis in den deutschen Wattengebieten 1951-1953." Ber.d.Deutschen Wissensch.Kommission f.Meeresforsch. N.F. Im Druck.