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GASTROLECITHUS PLANUS (LINTON) (CESTODA, TETRAPHYLLIDEA) PARASITIZING CETORHINUS MAXIMUS (GUNNERUS) (ELASMOBRANCHII) FROM THE NORTH SEA

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with 9 text-figures

Introduction

In 1889 Van Beneden described a new tetraphyllid cestode, *Dinobothrium septaria,* for which he erected a new genus. It was peculiar in having a rather small body with a very large scolex, the largest of all tapeworm holdfasts. Since then a small number of other species of *Dinobothrium* have been described (for two of them new genera were proposed, viz. *Gastrolecithus* Yamaguti, 1952 and *Reesium* Euzet, 1955). They have only been found in large sharks, both in preying and in plankton feeding species. Mola (1907) was the first investigator who found such a tapeworm in the Basking Shark, *Cetorhinus maximus* (Gunnerus).

Euzet (1955) has tried to elucidate the remarkable and confused history of these animals. He recognized three genera and only three species, viz. *Dinobothrium septaria* van Beneden from *Lamna nasus* (Bonnaterre), *Gastrolecithus planus* (Linton) and *Reesium paciferum* (Sproston) both from *Cetorhinus maximus* (Gunnerus). Some incidental finds from other sharks have a doubtful status. The most remarkable fact is that these three species with similar scolices were placed in three different families: *Dinobothrium septaria* in the family Phyllobothriidae, *Reesium paciferum* in the family Prosobothriidae, while Euzet proposed a new family, Gastrolecithidae, for *Gastrolecithus planus.* However, it is the opinion of the present author that this view will not generally be accepted. It is improbable that the characteristic scolices would have evolved in three families.

In the present paper *Gastrolecithus planus* is recorded from *Cetorhinus maximus* captured in the North Sea near the Dutch coast.

Gastrolecithus planus (Linton, 1922)

Dinobothrium septaria — Mola, 1907: 4-6 (Mediterranean near the island of Elba, Italy); Masi, 1912: 323-328 (Mediterranean); Nybelin, 1914: 228-230 (Skagerrak near Kurkesund, Bohüslan, Sweden); Tseng, 1933: 1-21 (Yellow Sea near Chefoo, Shantung, China).

Dinobothrium septaria (part.) — Joyeux & Baer, 1936: 49, 550.

Phyllobothrium septaria (part.) — Southwell, 1925: 169-171.

Dinobothrium planum Linton, 1922: 5-8 (North Atlantic, near Martha's Vineyard, Massachusetts, U.S.A.; type locality); Woodland, 1927: 231-233, 238, 240; Perrenoud, 1931: 501, 517-518; Guiart, 1933: 468-473; Guevara Pozo, 1945: 260-270 (Mediterranean, near the island of Mallorca, Spain); López-Neyra, 1945: 223-224; Sproston, 1948: 76-80, 86-88 (The English Channel, near the island of Soay, Hebrides, Scotland; Pacific, near Japan); Matthews & Parker, 1950: 571 (North Atlantic, near the island of Soay, Hebrides, Scotland); Wardle & McLeod, 1952: 245-246; Delamare Deboutteville & Euzet, 1952: 217 (Mediterranean, near Narbonne, France); Euzet, 1952: 172 (same locality); Riser, 1955: 280-281 (Pacific, Montery Bay, California, U.S.A.).

Gastrolecithus planus — Yamaguti, 1952: 38-40 (Pacific, near Japan); Euzet, 1955: 181-185 (North Atlantic, near Concarneau, Finistère, France; Mediterranean, near Cabanes-de-Fleury, Aude, France; North Atlantic, near Dakar, Sénégal); Yamaguti, 1959: 74-75.

Dinobothrium plicitum — Legendre, 1923: 278-279 (North Atlantic, near Concarneau, Finistère, France); Joyeux, 1923: 344 (same locality); Guevara Pozo, 1945: 260-270 (Mediterranean, near the island of Mallorca, Spain); López-Neyra, 1945: 224 (North Atlantic, near Santander, Spain).

Material. — 1 specimen; in spiral-valve of young specimen of *Cetorhinus maximus* (length 4.6 m); „Achter-de-stenen", North Sea, off the island of Texel, The Netherlands; captured by fishing boat HD 220; 21 October 1964; dissected by J. van der Land, 22 October 1964; RMNH coll. no. 3018.

Slides. — RMNH slide no. 3019: transverse sections of one proglottid, stained with Mallory. RMNH slide no. 3020: whole mount of one proglottid, stained with Luxol-fast-blue and Cresyl-fast-violet; prepared by J. Dubbeldam.

Description. — The whole length of the animal (measured in the fixed state) is 18 mm. The scolex consists of four bothridia: a dorsal pair and a ventral pair (fig. 1-3). Its length is 4.2 mm and its width across the widest

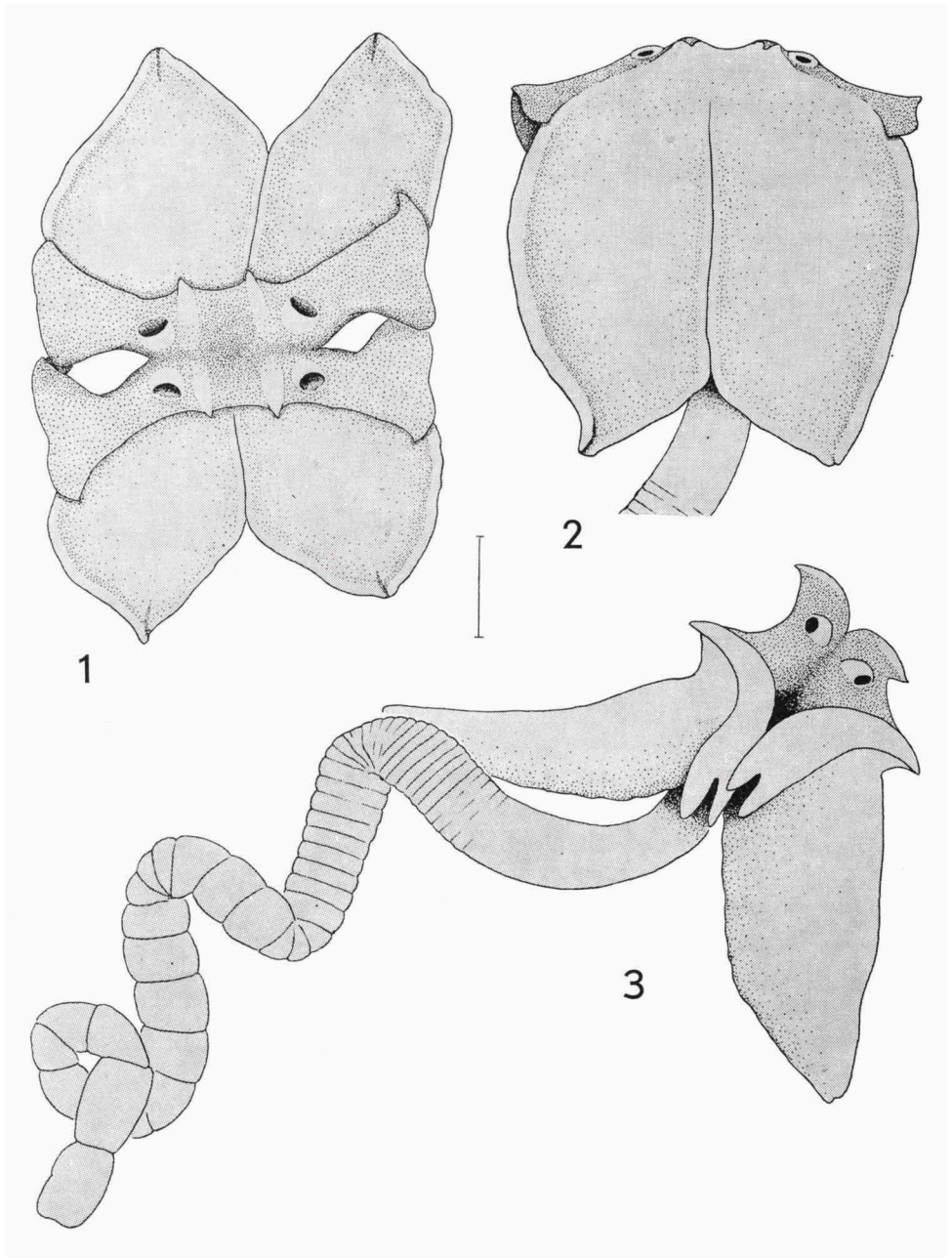

Fig. 1-3. *Gastrolecithus planus* (Linton). 1, scolex, anterior view; 2, scolex, ventral or dorsal view; 3, strobilus and scolex, the latter in lateral view. The scale represents 1 mm.

part of a pair of bothridia 4.5 mm. The scoop-shaped bothridia are pointed distally. The distal ends have a central furrow and are free for about one third of their length. The two bothridia of a pair are grown together anteriorly and possess a common anterior ridge. The median parts of the dorsal and ventral ridges are also grown together. The ridge of each bothridium bears two curved, pointed processes, a sucker and a lateral appendage. The two adjacent processes of a bothridia pair are placed at some distance from each other and close to the suckers. The latero-anterior angles of the bothridia are broadened and provided with an abaxial, pointed processus and an adaxial, bifid appendage. No spines could be found on the adaxial face of the bothridia.

The strobilus is twisted in the fixed state. The unsegmented neck, about 0.6 mm thick, is shorter than the bothridia. About 50 proglottides are present. The posteriormost proglottides are longer than broad (measurements: 940 × 720 μ, 970 × 700 μ). They have convex lateral sides. Two inconspicuous longitudinal furrows are present on the dorsal surface.

Reproductive organs could not be found in the transverse sections. The „excretory system" consists of two large ventral vessels (diameter about 50 μ) and two small dorsal vessels (diameter 5 to 10 μ), the latter lying straight above the former. The ventral vessels are connected in the posterior part of the proglottid. It is possible that the connecting vessel has an opening to the exterior, as was found by Woodland (1927) in *Dinobothrium septaria,* but the condition of the last sections does not permit a definite conclusion. The nerve trunks are situated just inside the lateral edge of the well developed sheath of longitudinal muscles.

Discussion. — In mature specimens of *Gastrolecithus planus* the proglottids are always much wider than long. In the present specimen the oldest proglottids are longer than wide. Similar specimens were found by Euzet (1955) and Guevara Pozo (1945). They strongly resemble *Dinobothrium septaria* but it is improbable that the plankton feeding shark *Cetorhinus maximus* would be infected by *Dinobothrium* as the intermediate hosts of the latter are large Cephalopoda. In fact this is the only reason why Euzet considered his immature specimens to be *Gastrolecithus*. It is quite probable, however, that constant morphological differences occur between the immature forms of *Gastrolecithus* and *Dinobothrium*. A useful differential character seems to be the distance between the two median processes on the common ridge of each pair of bothridia. In *Dinobothrium* the two processes nearly touch each other, but in *Gastrolecithus* they are placed some distance apart (fig. 1-2). This is more or less clearly shown in the figures of *Gastrolecithus* given by Mola (1907), Nybelin (1914), and Sproston (1948), and in the

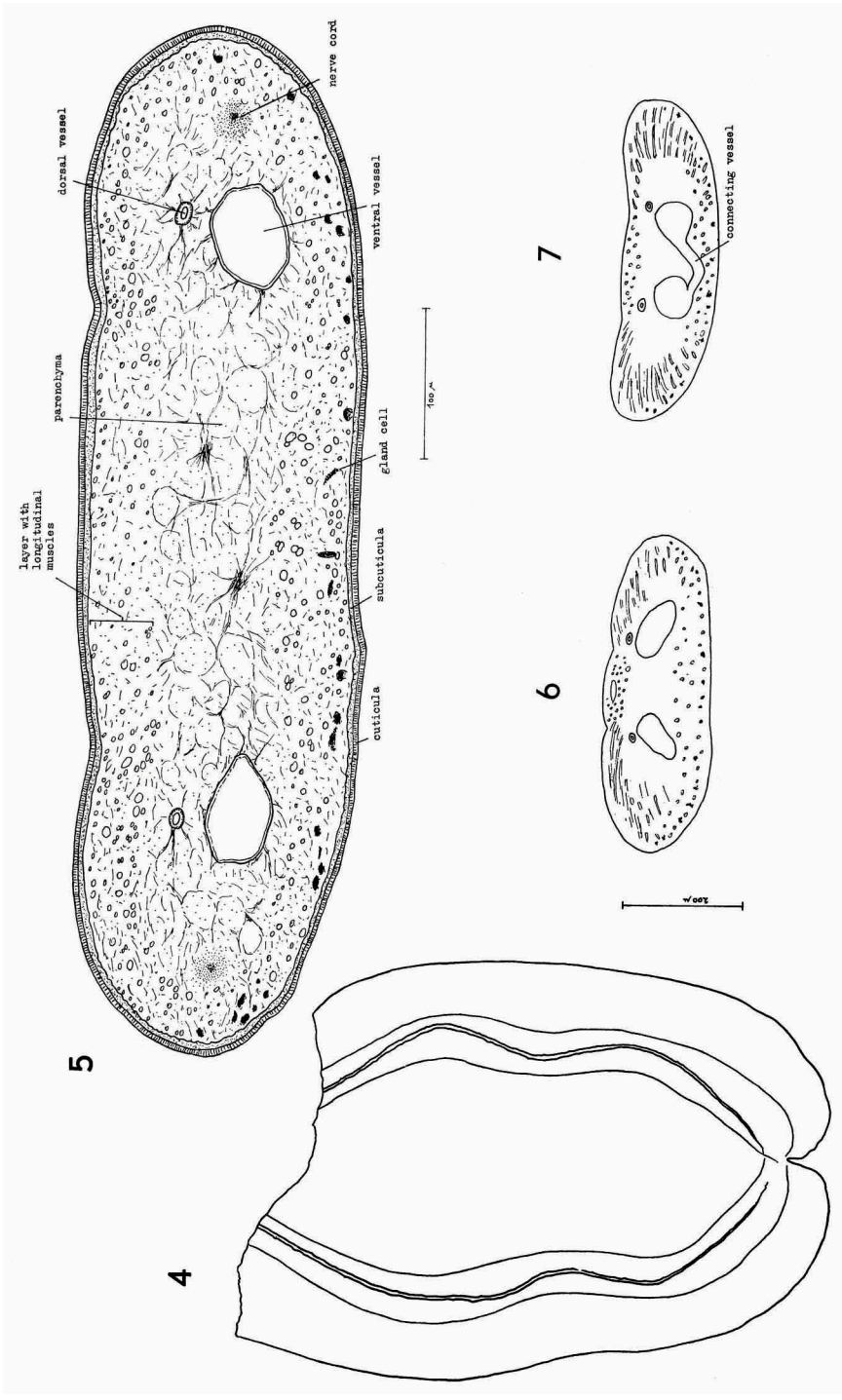

Fig. 4-7. *Gastrolecithus planus* (Linton). 4, terminal proglottid with dorsal and ventral vessels; 5-7, transverse sections of proglottid; 5, central part; 6, close to anterior edge; 7, close to posterior edge.

figures of *Dinobothrium septaria* published by Van Beneden (1889), Woodland (1927) and Euzet (1955). The processes are not always clearly visible in large specimens (Baylis, 1950), but their broadened bases can always be recognized easily.

In the larval forms of *Dinobothrium septaria,* found twice in Cephalopoda, viz. in *Ommastrephis* and in *Todaropsis,* the median processes are placed on the adaxial edge of the bothridia (vide Linton, 1897: pl. 2 fig. 11, and Dollfus, 1936: fig. 557C-E). It can be expected that this is not the case in *Gastrolecithus* larvae as this is not the case in adults either. These plerocercoids most probably occur in the intestine of small Cephalopoda, for instance *Sepiola,* a rather slow animal.

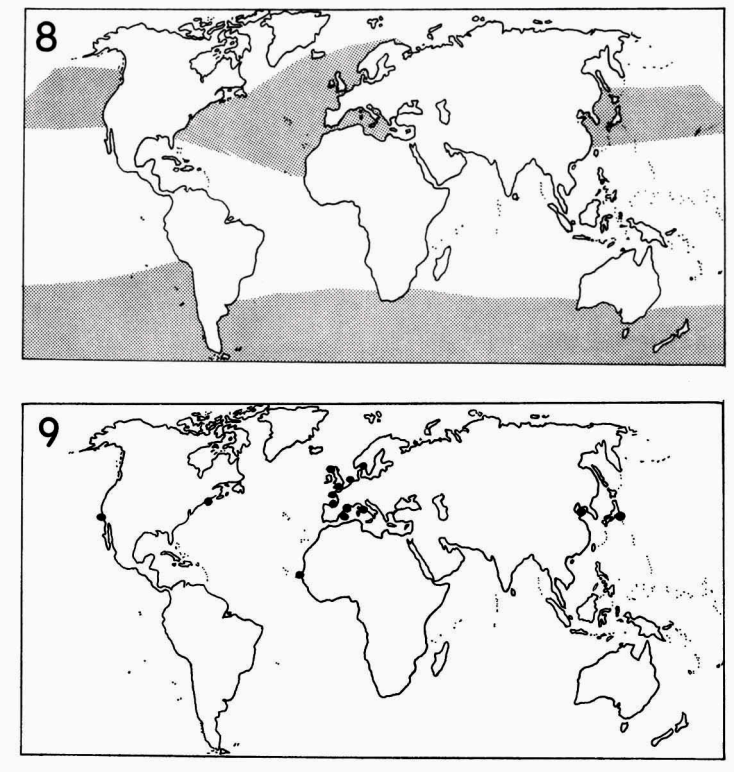

Fig. 8. *Cetorhinus maximus* (Gunnerus). Supposed distribution.
Fig. 9. *Gastrolecithus planus* (Linton). Known distribution.

Host. — The Basking Shark does not belong to the normal fauna of the North Sea. Only young specimens sometimes reach the Dutch coast, apparently coming from the North Atlantic, when they migrate to the south in the autumn. The present specimen was remarkably free from parasites,

only a number of Copepoda being present on the gills. The stomach and the intestine contained an orange coloured, slimy paste, which made the search for parasites very difficult. Parts of the following organisms could be recognized in this paste: Chaetognatha (*Sagitta* spec., *Eukrohnia hamata* (Möbius), *Eukrohnia* spec.; det. S. van der Spoel), Ostracoda, Copepoda, Decapoda (shrimp), Gastropoda (juveniles), Pteropoda (*Limacina* spec., *Limacina helicina* (Phipps), *Peraclis* spec.; det. S. van der Spoel), fish eggs. It is interesting that some of these organisms do not occur in the southern part of the North Sea (*Eukrohnia, Peraclis*) or are rare there (*Limacina*). This fact makes it probable that the food was obtained in the Atlantic or in the northernmost part of the North Sea, which supports the theories of Parker & Boeseman (1954). In their opinion Basking Sharks do not feed in the autumn and winter, and the food in the intestines is digested very slowly then.

Geography. — *Cetorhinus maximus* occurs in the temperate regions of all oceans (fig. 8) but not much exact information about its distribution and habits is available (vide Bigelow et al., 1948). Next to nothing is known about the geographical variation, which is of course due to the fact that it is difficult to obtain many specimens and that it is nearly impossible to preserve complete animals in museums. Most authors accept only one species of Basking Shark, but it is not impossible that more than one species or subspecies should be recognized.

The same may apply to the parasite. Until now this has only been found in the North Atlantic and the North Pacific (fig. 9). It would be very interesting to know if this species also occurs in the southern oceans.

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The papers marked with an asterisk (*) were not seen by me.