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ON THE GENUS *ULOPHYSEMA* BRATTSTRÖM WITH DESCRIPTION OF A NEW SPECIES FROM EAST GREENLAND

BY

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WITH 7 FIGURES IN THE TEXT AND 1 PLATE

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INTRODUCTION

During the Danish Three-Year Expedition to East Greenland 1931—34 under the leadership of Dr. LAUGE KOCH zoological investigations were made from the s/s "Godthaab". In 1932, during the summer, the zoologists were working on board this ship in the Franz Joseph Fjord area. By dredging with Sigsbee-trawl on great depths they collected a considerable number of the strange irregular Echinoid *Pourtalesia jeffreysi* WYVILLE THOMSON. After returning home Mag. sc. GUNNAR THORSON, Copenhagen, who together with Dr. R. SPÄRCK had done the collections mentioned, undertook to measure the size of the mature eggs of all the most common bottom-invertebrates of North-East Greenland. During this investigation he found in several specimens of *Pourtalesia* great sac-formed structures filled with a very great number of eggs and (or) larvae in the nauplius-stage. He supposed to have found a new species of Cirripedian parasite of the order Ascothoracica. Dr. K. STEPHENSEN in Copenhagen was asked to describe this new animal, but he had no opportunity doing it. So I got this species for description through him and Professor Dr. TORSTEN GISLÉN in Lund. I therefore want to express my deep obligations to these two gentlemen. Particularly, however, I direct my gratitude towards Mag. sc. GUNNAR THORSON for kindly entrusting me with the description of this new and interesting type and for all help he has given me in many ways and on various occasions.

I also got the opportunity of examining all the collections of *Pourtalesia* from earlier Danish expeditions which are deposited in the Zoological Museum of the University of Copenhagen, on account of which I want to express my thanks to Dr. P. L. KRAMP, the director of the Department in question and to his assistant Mag. sc. SVEN HEDING. From the State Museum of Natural History in Stockholm and from the Zoological Museum of the University of Uppsala all their specimens of *Pourtalesia* collected by Swedish and Norwegian expeditions have been put to my disposal for the aim of comparison. I am indebted to Professor Dr. SIXTEN BOCK and Dr. IVAR ARWIDSSON for lending me this valuable

material. By all this courtesy from different scientists and institutions I got the opportunity of examining about 25 specimens of the parasite, which has been of great aid to me. At last I wish to thank my friends ERIK DAHL and GEORG BORGSTRÖM for helping me with the translation of this paper.

The material examined is collected by the following expeditions.

The Norwegian North-Atlantic ("Vöringen"-) Expedition in 1876—78.
The Danish "Ingolf" Expedition in 1895—96.
The Swedish Expedition to Spitzbergen in 1898.
The Swedish Expedition to Greenland in 1899.
The Swedish Zoological Arctic Expedition in 1900.
The Danish "Godthaab" Expedition in 1928.
The Danish Three-Year Expedition to East Greenland in 1931—34.

The parasite, I am going to describe, was probably discovered already during the Norwegian North-Atlantic Expedition or shortly afterwards, for among the material from the State Museum in Stockholm there was a tube containing two free-dissected specimens of the parasite (pl. I, 8 and 9), which according to the label originated from the Atlantic Ocean, where they had been collected by DANIELSSEN. It is true, that further particulars are missing, still it is very probable, that the animals in question belong to the material brought home by this expedition. Firstly in the same collection there was material labelled "Atlantic Ocean, Vöringen, st. 295, DANIELSSEN", and secondly it is known, that DANIELSSEN sent the *Pourtalesia*-material of the Norwegian North-Atlantic Expedition to Stockholm to be examined by LOVÉN, who based his famous paper "On Pourtalesia" on these specimens. So it is to be supposed, that it is the latter material or parts of it, that now belongs to the State Museum in Stockholm. Possibly DANIELSSEN himself has found the parasites, but it is still more probable, that LOVÉN by his researches on *Pourtalesia* has come across them, though without describing them. Perhaps he did not even realise, that these two sac-like formations were Crustacean parasites, transformed in a strange way.

After THORSON's recent rediscovery of the parasite in the Franz Joseph Fjord and after his assuming it being an Ascothoracican, HEDING examined all the *Pourtalesia* from this locality. Thanks to the thin and transparent shells of these sea-urchins it was not necessary to dissect them for establishing whether they were infected or not. It was sufficient to hold them over an electric lamp in order to see if there were any irregularities in the organisation of the intestines, indicating the presence of parasites. I myself have successfully used this simple method on all the material examined. It has proved an invaluable method, *Pourtalesia*

being a comparatively uncommon and delicate deap-sea species. However a great deal of the sea-urchins were so darkly pigmented, that the internal organs could not be clearly observed through the shell. So this method was combined with an examination of the shell itself, for in all the *Pourtalesia* Heding found to be infected, I discovered a hole brought about by the fullgrown parasite at the place of its adherence (see below p. 10. Comp. Brattström 1936, p. 2 and fig. 1 B). Though these two methods, even when combined, not are quite reliable, especially when the percentage of infected *Pourtalesia* is to be calculated — the young parasites have not produced any holes large enough to be observed or there may be small holes, which not are caused by a parasite — most of the fullgrown parasites are, however, detected in this way. So only those *Pourtalesia* are dissected, which are supposed to be infected, and in this way the waste of all un-infected specimens is avoided.

ON THE GENUS *ULOPHYSEMA* BRATTSTRÖM

The assumption of THORSON, that the parasite was an Ascothoracican, turned out to be correct. Undoubtedly it belongs to the genus *Ulophysema*, recently described from the Sound by the present author (BRATTSTRÖM 1936). After the host, in which it is found, I give this new species the name *Ulophysema pourtalesiae*. With the discovery of this species, the order Ascothoracica for the first time is recorded from Greenland waters. Earlier the following species of this group have been found in the Northern Atlantic and adjacent waters.

Ascothorax ophioctenis DJAKONOV, from Novaja Zemlya (DJAKONOV 1914), SW, NE and E of Iceland, N of the Faroes (STEPHENSEN 1935).

Dendrogaster astericola KNIPOWITSCH, from the White Sea (KNIPOWITSCH 1891 and 1892).

Dendrogaster murmanensis KLUGE, from the Murman Coast, the Kola Fjord (KORSCHELT 1933).

Dendrogaster? *sp.*, larva, from Canada, Passamaquoddy Bay (MCMURRISH 1917).

Ulophysema öresundense BRATTSTRÖM, from the Sound (BRATTSTRÖM 1936).

As was the case with *U. öresundense* the description of this new species is preliminary and based on purely morphological observations. Later on it is my intention to describe the internal anatomy as far as it can be studied by sectioning the material, which is not particularly preserved for this purpose. Also certain characteristics, for which more material is needed for comparison, will be discussed later on.

Ulophysema pourtalesiae n. sp.

The mantle.

(Fig. 1 and plate 1, 7—9).

The sac-like structure constitutes the mantle of the animal, embracing the actual body (1, *b*), which is invisible, unless the mantle is cut open. The mantle is to be considered as a duplicate of the body-

wall. It looks like a bent, stretched sac, flattend from the sides, and is composed of two parts, one long anterior part (1, *a s*), and one posterior part (1, *p s*), somewhat shorter, which is bent in a perpendicular or acute angle to the former. In this way the two shanks of the sac will often lie more or less parallely. In the very curve there is to be seen on the outer side (ventrally) a small projection (kegelförmige Erhöhung, BRATTSTRÖM 1936, p. 2), the point of which is provided with a small opening, representing the mouth of the mantle cavity (1, *m o*).

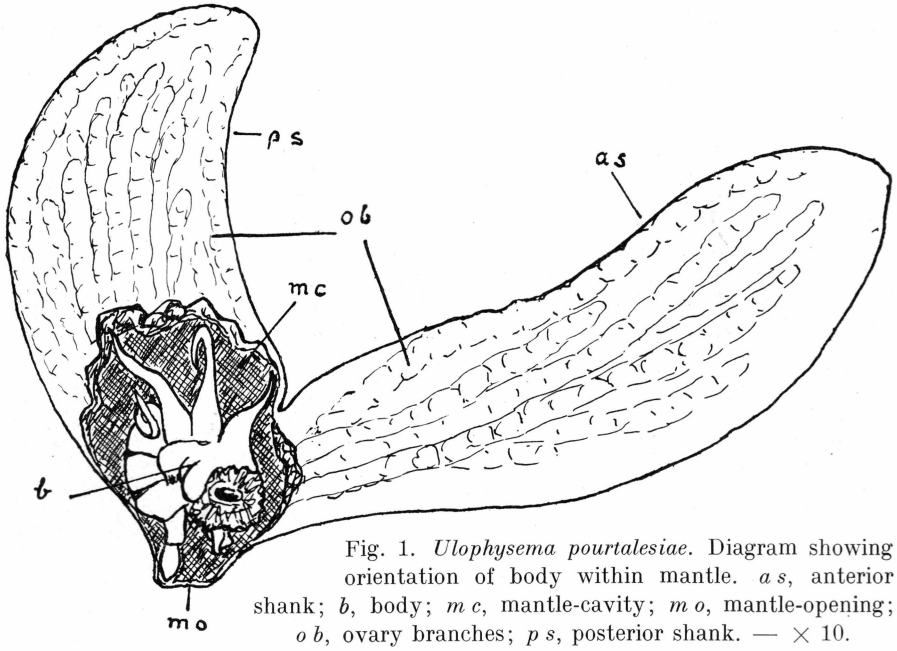

Fig. 1. *Ulophysema pourtalesiae*. Diagram showing orientation of body within mantle. *a s*, anterior shank; *b*, body; *m c*, mantle-cavity; *m o*, mantle-opening; *o b*, ovary branches; *p s*, posterior shank. — × 10.

Immediately inside this opening the animal is located with its abdomen often protruding through the opening. As is to be seen from the diagram, fig. 1, the animal only occupies a very inconsiderable part of the cavity. The surface of the mantle is nearly even — only the ovary branches, which are distinctly visible through the wall, produce low, swelling ridges (1, *o b*). The colour of the mantle is on alcohol-preserved specimens whitish or yellow. Sometimes the sac is almost transparent, with the ovary branches like yellow strains crossing the surface.

The length of the anterior shank of the mantle amounts by the fullgrown animal to 12—15 mm, while the posterior shank is about 8—12 mm in length. Both these measures are taken from the mouth of the mantle straight to the apex of the two shanks. The "height" of the shanks amounts to 4—5 mm, the posterior shank generally being

somewhat higher than the anterior one. The former has its highest point in the middle, while the latter is comparatively even. The width averages between 2 and 3 mm.

The mantle surrounds an unbroken cavity (1, *m c*), filled with eggs or (and) larvae. The walls are composed of a very loose tissue, through which branches from the gut and the ovaries are running as more solid strains.

Relationship of the host and parasite.

As was the case with *U. öresundense* at least the fullgrown specimens of *U. pourtalesiae* are fastened dorsally inside the sea-urchin (fig. 2 and

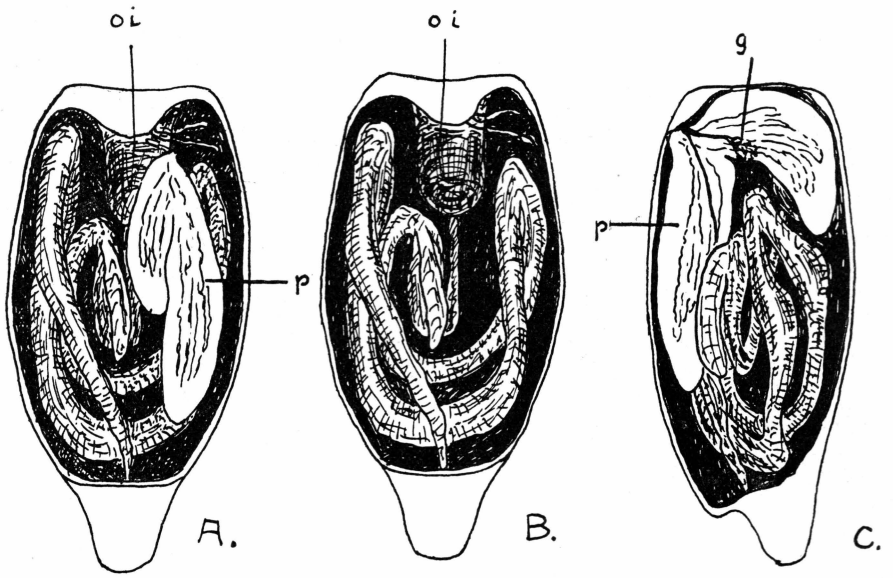

Fig. 2. Diagram showing the orientation of the parasite in the host. A. Dorsal view of an infected *Pourtalesia*. B. The same animal without the parasite. C. An infected *Pourtalesia* in lateral view. *g*, reduced gonad of the host; *o i*, oral invagination; *p*, parasite. — × 2.

pl. I). This fastening always takes place near the genital pores, where the parasite produces the above-mentioned hole in the roof of the shell (pl. I, 2 and 3). The mouth of the mantle is attached to this hole. So the animal lies with its back downwards with the both shanks hanging freely in the coelomic cavity of the sea-urchin, and occupies the space between the roof of the shell and the gut slings (fig. 2). The parasites often get mixed up with the mesenteries of the sea-urchin and partially hang in these. Most commonly they are situated at one side of the median line of the sea-urchin. This fact is explained by the well-developed oral invagination (2, *o i*) of *Pourtalesia*, which fills a great deal of the central part of the cavity. Further the parasite is situated in such a

position, that the long anterior part of the mantle is directed towards the back part of the sea-urchin, lying close to the dorsal side of its shell, while the posterior shank of the mantle is pointing ventrally and backwards along the ventral part of the sea-urchin (2 C). Thus *Ulophysema* in relation to its host is lying not only upside down but also with the wrong end foremost. Large parts of the mantle lie close to the shell of the host and becomes often more or less attached to it. In spite of all precautions at the preparation of the parasite it is sometimes impossible to take it out without injuring it.

There are no external differences between the infected and the uninfected *Pourtalesia*. Only the little hole mentioned above and situated near the genital pores indicates the presence of a parasite in the interior of the animal, which is fatal for its host. For although the sea-urchin does not seem to suffer from the parasite in any other respect, the latter injures the reproductive organs of the former. Often the *Ulophysema* completely castrates its host. In an uninfected male of *Pourtalesia* the genital organs are bush-shaped with a long efferent duct (pl. I, 11), while the female genital organs form thick, unbranched tubes (pl. I, 10). The gonads of the infected animals, however, are stunted and appear as small, thread-like vestiges (pl. I, 12 and 13). In places, where this parasite is abundant, as is the case at the type-locality in the Franz Joseph Fjord, where nearly half of all the fullgrown *Pourtalesia* were infected, it must to a considerable degree affect the reproduction of these sea-urchins.

As a rule not more than one parasite is to be found in each *Pourtalesia*, but in two cases, both from the type-locality, I have observed two *Ulophysema* of somewhat different size in the same host (see pl. I, 3).

The body.

(Fig. 3).

Like other Ascothoracicans *U. pourtalesiae* is composed of two parts, the animal itself and the mantle. The latter, which has just been described, constitutes a breeding sac, fastened to the head of the body behind the oral cone (see below) and on the ventral side of the gut. The animal is sharply curved, so the head with the oral cone and the abdomen are bent in below the thorax and point towards the mouth of the mantle and therefore also towards the hole in the shell of the sea-urchin. Owing to this flexure of the front part and the back part of the animal its length only amounts to about 2 mm, while the total length of the two parts of the mantle is 20—25 mm.

The head. In the anterior part of the body it is very difficult to make out the different structures, on account of the fastening of the mantle here, which cannot be wholly removed (3, *m*). Here lateral diverticula from the gut and ovaries pass from the body into the walls of

the mantle. Ventrally there protrudes an oral cone (3, *o c*), which is compressed from the sides and flanked by a pair of broad, flat antennulae (3, *ant.* and fig. 4 A), each measuring about 0.6 mm in length. These antennulae are composed of four (possibly five) rather short and broad joints, internally provided with well-developed muscles, indicating great mobility. The distal joint is supplied with a strong claw (3, *c*, 4 A, *c*),

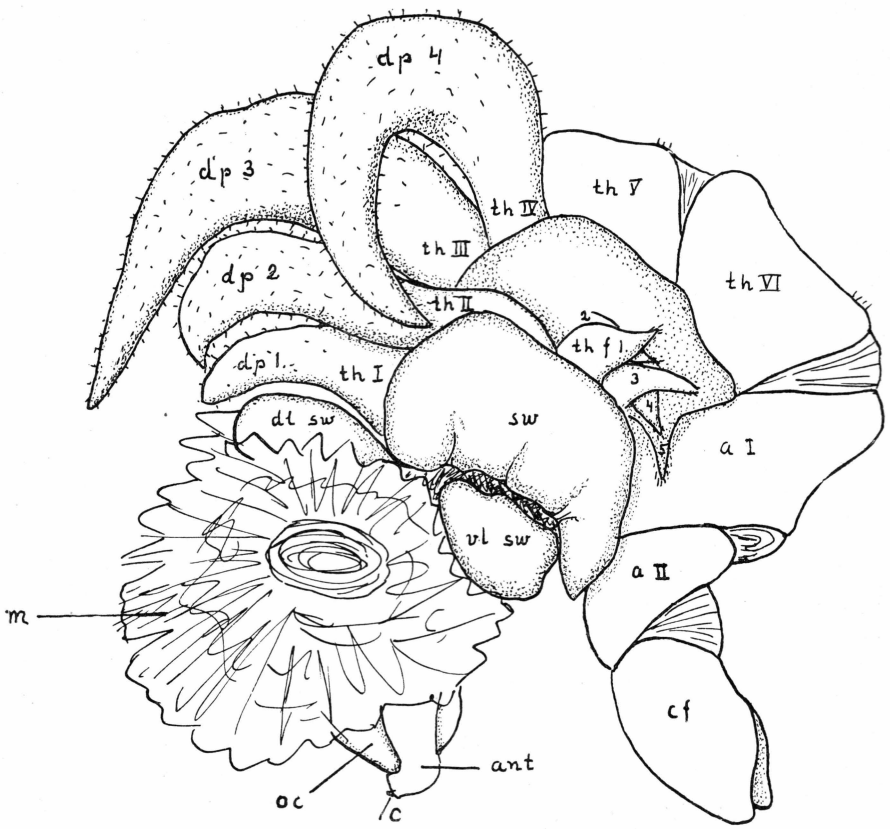

Fig. 3. *Ulophysema pourtalesiae*, lateral view of the body. *a I—II*, abdominal segments; *ant*, antennula; *c*, claw; *c f*, caudal fork; *dl sw*, dorsolateral swelling; *d p 1—4*, dorsal processes; *m*, mantle; *o c*, oral cone; *sw*, swelling; *th I—IV*, thoracic segments; *th f 1—5*, thoracic feet; *vl sw*, ventrolateral swelling. — ×50.

which is pointing forwards. The number of mouth parts cannot be counted without sectioning.

Behind the oral cone there is dorsolaterally a slight swelling (3, *dl sw*), by a thin strain connected with a similar ventrolateral structure (3, *vl sw*). Whether these swellings belong to the head or to the thorax is not to be ascertained. Nor is there anything definite to be said about their function. As already has been stated, it is on the whole very difficult

to get an idea of the organisation of the anterior parts of the animal, without having access to series of sections from well-preserved material.

The thorax, the dorsal part of which is laterally compressed, widens ventrally and becomes much broader than that of *U. öresundense.* So it has a very stout appearence. As was the case also with the previously described species, the thorax of *U. pourtalesiae* has, on the dorsal side, four long, unpaired, hornlike processes (3, *d p 1—4*; schlauchförmige Anhänge, BRATTSTRÖM 1936, p. 3), which are considerably more slender and acute than by *U. öresundense.* It is true, that these processes vary much in the appearence, probably depending upon the preservation, but as a rule the anterior horn is small while the three posterior ones are on the contrary well developed. These horns are now and then pressed down towards the thorax or along its sides, but also in this case the preservation may probably be the cause, for in some specimens (see fig. 1) at least the three posterior horns point straight out into the mantle cavity. They are equipped with short and thin hairs.

Ventrolaterally there is a still larger swelling (3, *sw*) on each side below the first horn-like process and immediately behind the above-mentioned swellings at the back edge of the oral cone. The ventral end of this swelling is free and sometimes prolonged to what resembles a clumsy foot. To this structure, the shape of which is varying in different specimens, I will soon return.

Behind this organ there are on each side five small appendages (3, *th f 1—5*), which protrude ventrally from the broadest part of the thorax and which are distally provided with thin, short hairs. Most probably these five appendages, the last of which is generally shorter than the four anterior ones, represent the strongly reduced pairs of the thoracic feet. Ventrally the respective appendages of each side are connected by low, transversing folds.

The first dorsal hornlike process can be distinctly traced down along

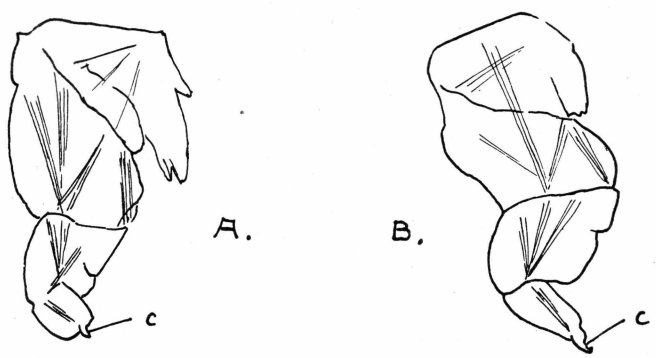

Fig. 4. A. Right antennula of *Ulophysema pourtalesiae.* B. Right antennula of *Ulophysema öresundense. c*, claw. — × 75.

the sides of the thorax to the last swelling (*sw*) mentioned above. Also the three posterior processes may be clearly traced down towards the ventral broadening of the thorax, where they disappear somewhere right above the three anterior pairs of appendages, considered as thoracic feet. Posterior to the horns there are two well-developed (comp. *U. öresundense*, p. 20) segments (3, *th V* and *VI*), the tegument of which dorsally and laterally is to a certain degree thickened. Some small hairs are to be seen on their dorsal side. These segments lack every trace of dorsal projections and to them the last two pairs of vestigal thoracic feet seem to belong. Thus all favours the view, that the thorax consists of six segments and that the four dorsal horns are projections from the anterior four segments (3, *th I—IV*). So the first horn, though it is not paired, seems to occupy approximately the same place as the paired horns of the species of the genus *Baccalaureus*. It is also to be supposed, that the function in both cases is the same: to stir up the eggs and larvae in the mantle cavity (comp. YOSII 1931, p. 171).

I then return to the pair of lateral swellings (3, *sw*) in front of the five feet. The position of these swellings below the first horn, i. e., if my opinion of the segments is right, on the first thoracic segment, indicates their being a first, transformed pair of thoracic feet. Now it is true, that the cypris-larva of this species is not met with, but in *U. öresundense* (comp. also *Dendrogaster astericola*) the cypris only has five pairs of thoracic feet — at least I have not seen any footlike structures anterior to them — and so it is unlikely, that these swellings correspond to a pair of feet, for five distinct rudiments of thoracic feet of quite another shape are, as is stated above, to be seen on each side behind these structures (3, *th f 1—5*). It is also evident, that they correspond to the feet of the cypris-larva. The five appendages possess distal hairs, while nothing of the kind is to be found upon the swellings anterior to them. Perhaps these swellings have some function in the reproductive mechanism, for the female genital pore in some other Ascothoracicans is situated on the first thoracic segment. The swellings, which are anterior to these last mentioned ones (i. e. 3, *dl sw* and *vl sw*), may then correspond to the "excretory organ" of *Synagoga metacrinicola* OKADA (OKADA 1926, p. 72) and *Baccalaureus japonicus* BROCH (YOSII 1931, p. 170), which has a similar position. So it is possible, that also the swelling on the first thoracic segment (in spite of the position it might perhaps belong to the head) has something to do with it.

The abdomen. Posterior to the thorax is the short abdomen, which seems to consist of two segments (3, *a I—II*) and a short caudal fork (3, *c f*). The first abdominal segment is large and well-developed and does not differ from the sixth thoracic segment in any other respect than lacking feet-appendages and as it seems also hairs. Between the first segment and the second one with the caudal fork there is an angle.

The mutual mobility between the segments and the fork seems to be large, judging from the large soft sections in between. Especially between the second segment and the caudal fork there is a big section with this constitution, and this part may easily be mistaken for a short third segment. The caudal fork is short and well-developed but without spines, setae or hairs. In one specimen both rami were fused.

Development.

Almost without exception the mantle-cavity of the specimens examined contained eggs or nauplii. So these specimens are to be considered to be females, but whether this species is dioecious or hermaphrodite, as probably most of the Ascothoracicans, cannot be made out with certainty. Probably, however, it is hermaphrodite as must be the case also with *U. öresundense*.

The eggs are, when mature, to be found in the mantle-cavity. In the beginning they are of a spherical shape and have a diameter of about 0.3 to 0.4 mm. Later on they become more elongated. Eggs in different stages of development may be found in the same specimen, also together with nauplii. Often, however, all the eggs or larvae in one specimen are in the same stage of development.

The nauplii (fig. 5) are small, pear-shaped creatures, about 0.7—0.8 mm in length. They are longer and more depressed than those of *U. öresundense* and there is an indication of the two shells of a cypris. As is the case in all Ascothoracican nauplii lateral processes are not to be found. The posterior end has a short caudal spine (5, *c sp*). The larva is composed of an undifferentiated tissue, in the centre of which is an ovoid body of stored nutrient material (5, *n m*). Three pairs of unjointed

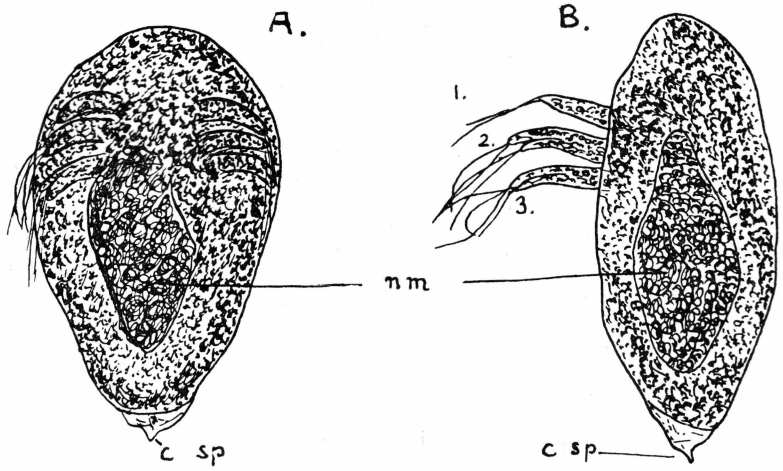

Fig. 5. *Ulophysema pourtalesiae*, nauplius larva. A, ventral view. B. lateral view. *c sp*, caudal spine; *n m*, nutrient material; *1—3*, appendages. — × 75.

Specimens of *Pourtalesia jeffreysi*

Date	Collecting expedition	St. nr.	Latitude	Longitude
1878, $^{14}/_{7}$	The Norwegian North-Atlantic Expedition	295	71°59′ N	11°40′ E
1876—78	»	—	Northern Atlantic	
1895, $^{9}/_{8}$	The Danish Ingolf Expedition	40	62°00′ N	21°36′ W
1896, $^{21}/_{7}$	»	113	69°31′ N	7°06′ W
» $^{23}/_{7}$	»	116	70°05′ N	8°26′ W
» $^{23}/_{7}$	»	117	69°13′ N	8°23′ W
» $^{24}/_{7}$	»	119	67°53′ N	10°19′ W
» $^{28}/_{7}$	»	124	67°40′ N	15°40′ W
» $^{10}/_{8}$	»	138	63°26′ N	7°56′ W
1898, $^{25}/_{7}$	The Swedish Expedition to Spitzbergen	26	78°19′ N	8°41′ E
1899, $^{4}/_{7}$	The Swedish Expedition to Greenland	18	74°52′ N	17°16′ W
1900, $^{20}/_{7}$	The Swedish Zoological Arctic Expedition	13	72°01′ N	8°33′ W
» $^{8}/_{8}$	»	21	Off the Franz Joseph Fjord, between Bontekoe Island and Mackenzie Bay	
» $^{14}/_{8}$	»	25	Mouth of the Franz Joseph Fjord	
» $^{27}/_{8}$	»	29	72°42′ N	14°49′ W
» —	»	—	—	—
1928, $^{14}/_{7}$	The Danish Godthaab Expedition	54	69°50′ N	61°36′ W
1932, $^{13}/_{8}$	The Danish Three-Year Expedition to East Greenland	96	73°15′ N	22°30′ W

SMS = The State Museum of Natural History in Stockholm. ZMC = The Zoological Museum of the University o

appendages are to be seen (5, *1—3*). The first pair is uniramous, the second and third pairs, however, are biramous. All the limbs have long natatory setae in their distal parts. — Eyes and other organs are not to be detected.

In spite of a very careful search cypris-larvae have not been observed. It is possible, that the larvae leave the mantle of the mother as early as in the nauplius-stage, for in other cases cypris-larvae might have been found. It is true, that the material only is recorded in July and August, so there is a chance, that cypris-larvae will be discovered in material from other months. But as the specimens examined are of different sizes and contain both eggs and nauplii, cypris-larvae also might have been found, if they develop in the mantle. In *U. öresundense* living in water with great periodical variations in temperature and salinity, both eggs, nauplii and cypris-larvae are to be found at the same time of year, and all these stages in the mantle-cavity.

WYV. THOMS. examined.

Depth in meters	Nature of bottom	Bottom-temp. °C.	Bottom-salinity ‰	Number of Pourta-lesia	Number of Ulophy-sema	Collection	Number on the map
2030	Biloculina Ooze	—1.3	—	3	0	S M S nr. 351	1
—	—	—	—	Frag-ments	2	» nr. 352	—
1591	Transition Clay	+3.3	34.95	4	0	Z M C	2
2465	Globigerina Ooze	—1.0	—	70	6	»	3
699	Transition Clay	—0.4	—	20	0	»	4
1889	Globigerina Ooze	—1.0	35.00	7	0	»	5
1902	»	—1.0	34.60	23	0	»	6
932	Gray Deep-sea Clay	—0.6	34.95	15	0	»	7
887	»	—0.6	35.22	20	0	»	8
2700	Biloculina Ooze	—1.4	—	7	0	S M S nr. 353	9
350	Clayey Ooze, Sand and pebbles	—	—	1	0	» nr. 354	10
2400	Ooze	—	—	13	1	Z M U	11
250	»	—	—	3	0	S M S nr. 356	12
200—300	»	—	—	6	0	Z M U	13
2000	Ooze with Foraminifers	—	—	104	9	»	14
—	—	—	—	3	0	»	—
1880	—	—0.4	34.50	75	0	Z M C	15
325	Clay with Stones	+1.5	about 34.90	35	about 15	»	16*

Copenhagen. ZMU = The Zoological Museum of the University of Uppsala. * Type-locality.

Distribution.

The material examined for *Ulophysema* consists of about 400 specimens of *Pourtalesia jeffreysi* WYV. THOMS. Also some *Pourtalesia wandeli* MRTSN. and *Pourtalesia laguncula* A. AGASSIZ were investigated by using the above-mentioned methods, but without any result. Of these 400 specimens of *P. jeffreysi* about 325 are collected at several stations in the Northern Atlantic between Norway, Spitzbergen, Greenland and the Faroes and 75 in the Baffin Bay, as is seen from the map (fig. 6) and from the table seen above. The bottom at these stations was different kinds of clay or ooze in those cases, when its nature has been annotated. When measured, the depths varied between 200 and 2700 meters, the bottom-temperatures from —1.4° to +3.3° C and the salinity from 34.50 to 35.22 per mille.

Of these 400 *Pourtalesia* about 30 were found infected with the *Ulophysema pourtalesiae*. The stations, where the parasite was found,

are, besides the type-locality in the Franz Joseph Fjord, one station between this fjord and the isle of Jan Mayen, one N and one S of this isle. Two specimens are from a station in the Eastern North-Atlantic. The depth is varying between 325 and 2465 meters. The bottom was, where it is noted, ooze of different types and clay. The only known bottom-temperatures were —1.0° and +1.5° C. The salinity at the type-

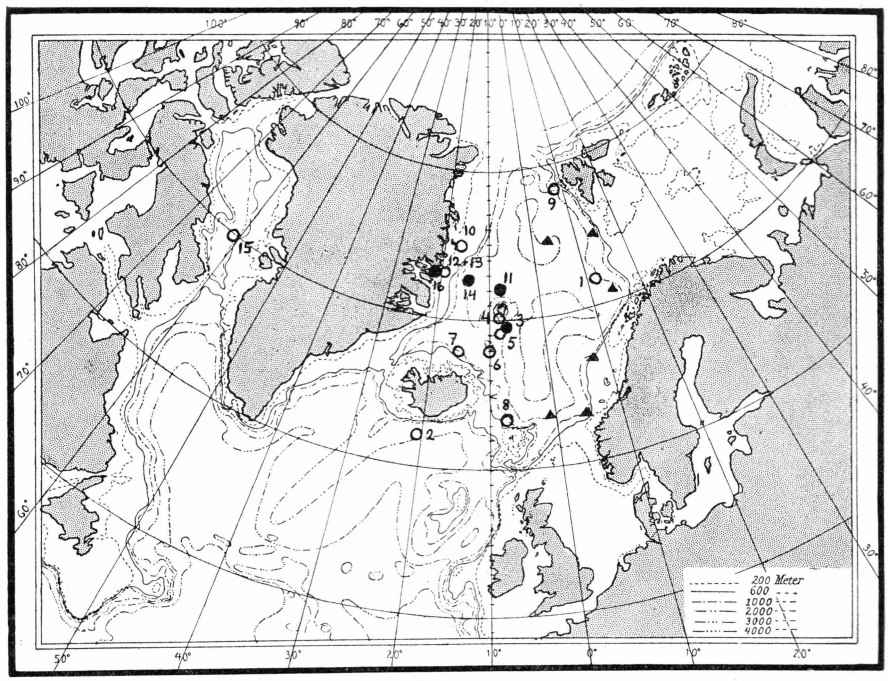

Fig. 6.

○ Station from which specimens of *Pourtalesia jeffreysi* are examined.

● Station from which *Ulophysema pourtalesiae* is recorded.

▲ Stations from which *Pourtalesia jeffreysi* is recorded by the Norwegian North-Atlantic Expedition. From one of these stations (or from st. 1) two specimens of *Ulophysema pourtalesiae* are recorded.

The numbers are the same ones as in the table. St. 16 is the type-locality.

locality was about 34.9 per mille. All specimens are, as is already mentioned, collected in the months of July and August (see the table, p. 16—17).

Ulophysema öresundense Brattström.

(Fig. 7).

Although it is my intention to give an account of the results of my investigations on this and other species in a future work, I now want to give some additions to and corrections of my preliminary note

(BRATTSTRÖM 1936). For a comparison with the more primitive *U. pourtalesiae* has made it possible to spread light on certain traits in the organisation, which earlier seemed unclear or questionable and therefore had to a certain degree been wrongly interpreted or overlooked. In *U. pourtalesiae* all organs are more definite and easier to distinguish. From the points of view, obtained at my reconstruction of this latter

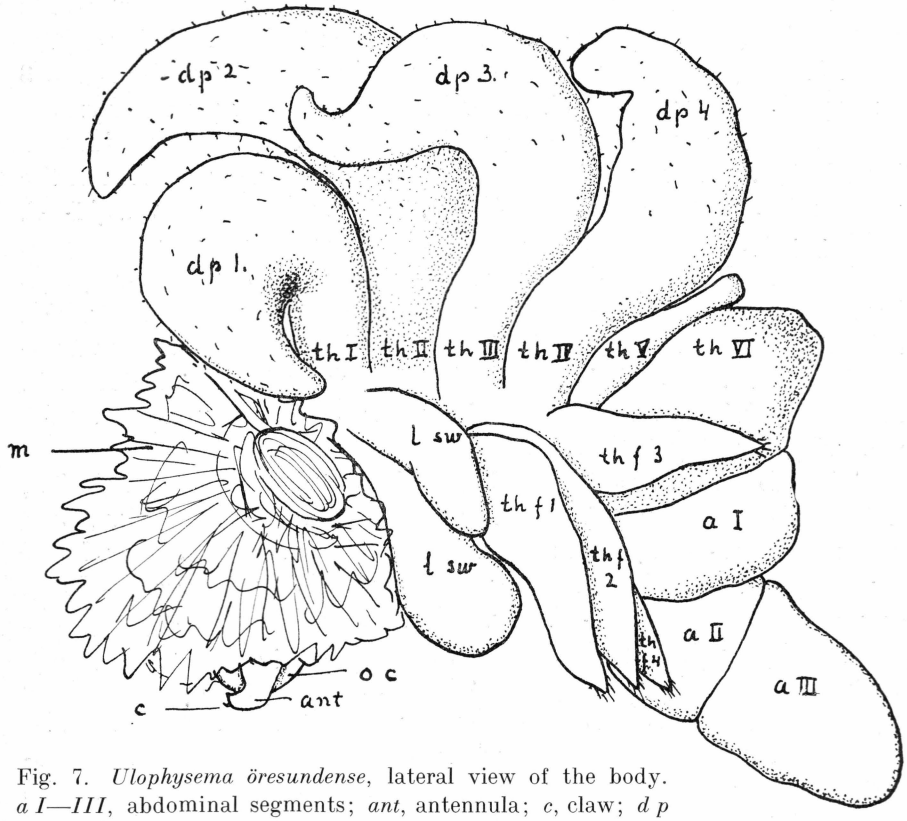

Fig. 7. *Ulophysema öresundense*, lateral view of the body. *a I—III*, abdominal segments; *ant*, antennula; *c*, claw; *d p 1—4*, dorsal processes; *m*, mantle; *l sw*, lateral swellings; *o c*, oral cone; *th I—VI*, thoracic segments; *th f 1—4*, thoracic feet. — × 50.

species, I have investigated more material of *U. öresundense*, and doing this I have used colouring methods, which have made the more indefinite organisation of this species to appear more distinctly than was the case earlier.

The head. The antennulae (fig. 4 B), previously undescribed, have four (possibly five) joints and are of the same type as by *U. pourtalesiae*, although the joints, especially the distal one, are a little more slender. The end-joint is equipped with a claw (4 B, *c*).

The thorax. In my preliminary description (p. 3) it was stated, that the thorax is not distinctly segmented, while this re-examination

has proved, that segment borders are discernible, although they are not so distinct as by *U. pourtalesiae.* So also in *U. öresundense* the thorax consists of six segments (7, *th I—VI*), the four anterior ones of which are dorsally elongated into the unpaired hornlike processes (7, *d p 1—4*), which here are heavy and all of about the same length. As was the case in *U. pourtalesiae* they are furnished with fine hairs, while hairs seem to lack at the fifth and sixth thoracic segments. These two latter segments vary in size (as is the case also in the four anterior ones). Especially the fifth segment is often very short and compressed. In the figure 3 in my preliminary note on *U. öresundense* four small appendages on the sides of the thorax are figured, which are referred to as rudimental thoracic feet. In many specimens these are better developed than in the specimen in the figure mentioned (comp. this fig. with the fig. 7, *th f 1—4*, in this paper). Anterior to the thoracic feet, I have in my previous figure scetched a swelling. In coloured specimens it is possible to observe, that this swelling really consists of two parts (7, *l sw*), the posterior of which at least seems to belong to the thorax. So here is an analogy to the swellings in *U. pourtalesiae.* Here too they vary in size and form in different individuals. If this fact is due to age differences or to the preserving is not yet clear.

The abdomen. It follows from this comparison and conclusion, that the abdomen of *U. öresundense* only consists of three or even two segments (7, *a I—III*), and not five, as I earlier believed. For what I previously — before I had made sure, that the thorax is segmented and composed of six segments — believed to be the first abdominal segment is really the sixth thoracic segment, for the last pair of thoracic feet has turned out to be placed right below it. So there remain four of the segments referred to as abdominal ones, while the real number is to be three (two). This error is easily explained, because the abdominal tegument is soft and consequently often folds, which seems to indicate the presence of more segments, than are really to be found. Repeated examinations have proved, that not always even three segments are to be found, for in several specimens only two may be observed. If so, the last one is rather elongated (two fused segments?). Once I have even noted a trace of a caudal fork(?) formed like a dorsocaudal fold on the last segment.

Comparison of the two species.

The comparison of the two species indicates *U. pourtalesiae* being more primitive than *U. öresundense.* Thus the former possesses five pairs of thoracic feet, while the latter only has four. The four dorsal thoracic processes, which are to be considered as secondary structures, are less developed in *U. pourtalesiae*, where they are shorter and more slender

than in *U. öresundense*. The presence in the former of a caudal fork also suggests a more primitive stage. Further the more pronounced segmentation and the more distinct structure of all organs in *U. pourtalesiae* points in the same direction. The mantle too is considerably simpler in this species. This is brought about by the absence of the numerous, small, irregular projections, characteristic of *U. öresundense*.

As to the relationship to other Ascothoracicans it is possible, that the relation to the family Lauridae, already pointed out in my preliminary note (p. 8), especially now, when a new and less reduced *Ulophysema* with a caudal fork has been found, is closer, than I originally was inclined to presume. This matter, however, will be dealt with in future publications, and so I here confine myself to this statement.

The description of the new species from East Greenland causes some alterations in the diagnosis of the genus *Ulophysema*.

Genus *Ulophysema* BRATTSTRÖM, 1936.

Mantle sac-shaped, unbranched, at most provided with low projections. Mantle-cavity unbroken, with a small opening ventrally. Besides the mantle, the body consists of three parts, a head with an oral cone and a pair of broad, flattened, four-(five-)jointed antennulae, a thorax and an abdomen. Thorax seems to consist of six segments. Thoracic feet four to five, reduced to small, uniramous and unjointed appendages. In front of these are two pairs of lateral swellings. The four anterior thoracic segments are each dorsally provided with an unpaired, hornlike process. Abdomen is two- to three-jointed with or without a caudal fork. Parasites in Echinoids.

Ulophysema pourtalesiae n. sp.

Mantle a prolonged, bent sac with an almost even surface. Antennulae with all joints, even the end-joint, broad. Five pairs of thoracic feet. The dorsal, unpaired processes of the thorax slender, acute, the foremost one often small. Abdomen of two segments and a caudal fork. Only nauplii are known. Endoparasite in *Pourtalesia jeffreysi* WYV. THOMS.

Type-locality: Greenland, the Franz Joseph Fjord, off Cape Franklin. Depth 325 m. Bottom clay with stones.

Further distribution: Northern Atlantic between Norway, Spitzbergen, Greenland and the Faroes.

Type-material in the Zoological Museum of the University of Copenhagen. Other material in the State Museum of Natural History in Stockholm and the Zoological Museum of the University of Uppsala.

Ulophysema öresundense BRATTSTRÖM, 1936.

Mantle more or less rounded with numerous small projections. Antennulae with at least the distal joint slender. Four pairs of thoracic feet. The unpaired, dorsal thoracic processes heavy, long and all of about the same size. Abdomen of three (two) segments and without a caudal fork. Development complete. The larvae leave the mantle-cavity of the mother earliest in the cypris-stage. Endoparasite in *Echinocardium cordatum* (PENNANT).

Type-locality: Sweden, the Sound. Depth 20—30 m. Gyttja-bottom.

Type-material in the Zoological Museum of the University of Lund.

Lund, Zoological Institution, June 10., 1936.

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Færdig fra Trykkeriet den 6. April 1937.

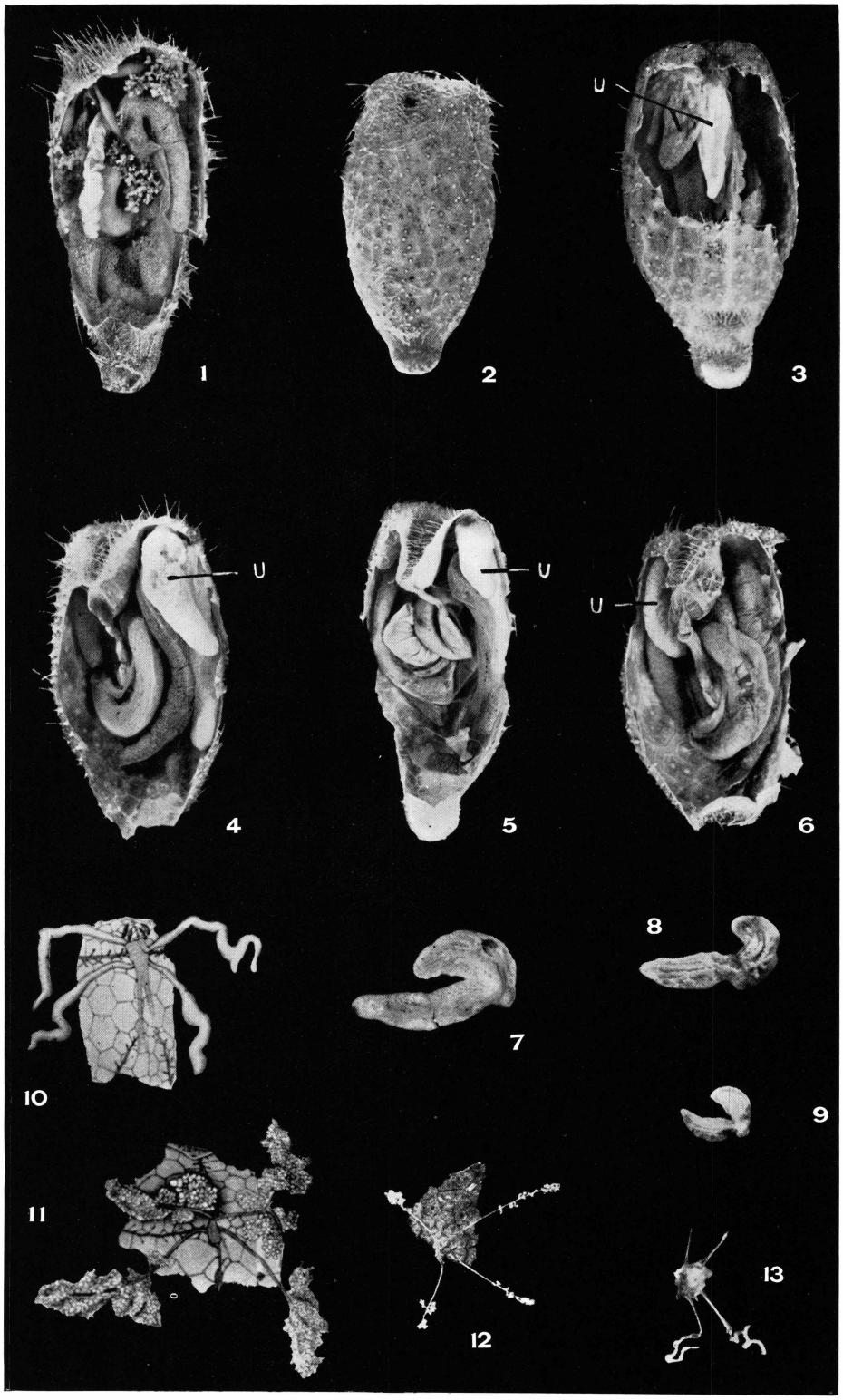
Explanation of Plate I.

(All figures about × 2.)

1. Dorsal view of an uninfected *Pourtalesia*. The gonads well-developed.
2. An infected *Pourtalesia* from the dorsal side, with the hole, made by the parasite.
3. One specimen of *Pourtalesia* with two parasites and with two holes in the shell.
4—6. Three infected specimens of *Pourtalesia* in ventral view.
7—9. Three specimens of *Ulophysema pourtalesiae* in lateral view.
10. Female gonads from an uninfected *Pourtalesia*.
11. Male gonads from an uninfected *Pourtalesia*.
12. Reduced male gonads from an infected *Pourtalesia*.
13. Reduced female gonads from an infected *Pourtalesia*.

Fig. 10—11 from MORTENSEN (The Danish Ingolf-Exp. Vol. IV. 2).

U = *Ulophysema pourtalesiae*.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