MEDDELELSER OM GRØNLAND
UDGIVNE AF
KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND
Bd. 124 · Nr. 10

PARASITIC HELMINTHS COLLECTED IN WEST GREENLAND

BY

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WITH 64 FIGURES IN THE TEXT

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI A/S
1956

Research undertaken with a grant from
the Swiss Foundation for Scientific Research

To the memory of

Harald Krabbe

pioneer in research on tapeworms from the Arctic

INTRODUCTION

The helminths studied in this paper were collected during a sojourn at the Arctic Station at Godhavn. It is our pleasant duty to thank professor R. SPÄRCK for organising our expedition as well as for the use of the "Holk" without which the most important bird colonies could not have been reached.

We also owe a debt of gratitude to Colonel R. MEINERTZHAGEN in whose company most of the field trips were undertaken, for his valuable aid in obtaining the birds and correctly identifying them.

The actual work of collecting and preserving the parasites has been greatly facilitated by the presence of our constant companion and assistant, Mr. J.-P. BARGETZI, B. Sc. to whom we tender our thanks.

Under such favourable circumstances, it is not surprising that it was possible to bring together in a relative short time a collection of well preserved helminths mostly from birds (see list below). The principal interest in their study resides in the fact that many of the tapeworm species formerly described by KRABBE from material sent him by Dr. PFAFF, a district physician in Jacobshavn, have been rediscovered in the identical type hosts. Since KRABBE only published drawings of the rostellar hooks with a short diagnosis, many of his species have been given a provisional status pending the discovery of their anatomical structure. The result now is, that in several cases nomenclatural changes have had to be made and species that had been placed tentatively in a genus, transferred to another one. In most cases, it has been possible to examine KRABBE's original slides and, sometimes even, cotype material for the loan of which we wish to thank the Zoological Museum of the University and the Parasitological Laboratory of the Royal Veterinary College in Copenhagen. We are also grateful to Miss GWENDOLIN REES, D. Sc. of University College Aberystwyth for loan of types described by DAVIES and to Dr. EMMET W. PRICE, of the Zoological Division of the U. S. Department of Agriculture, Beltsville Md., for loan of WEBSTER's types.

Ecological notes.

A study such as this, is interesting from an ecological standpoint as we are dealing with parasites from birds which are either wholly sedentary in the Arctic or only during the breeding season after which they migrate to the South.

The Fulmar, Iceland and Glaucous Gulls, the Kittiwake, Guillemots and Razorbill are exclusively sea birds in western Greenland and, consequently, their parasites are necessarily acquired from marine intermediate hosts. Chicks of Fulmar and Kittiwake while still at the nest, are fed entirely by the parents. In all the cases where such chicks could be examined, they were found to habour the same tapeworms as those occurring in the adult birds and in approximately the same numbers. An exception should be made, however, for the nematode *Stegophorus stellae-polaris* that is found in large numbers in the crops of Fulmar chicks but which is relatively rare in adult birds.

The European Cormorant, *Phalacrocorax c. sinensis* (Shaw & Nodder) harbours very frequently a small tapeworm that is characteristic for this species but which never occurs in the Greenland Cormorant, *Phalacrocorax c. carbo* L. a sea bird all its life. This also implies that the intermediate host of this tapeworm is a fresh-water form.

Anserines present a particularily interesting problem since nearly all of the species breed on inland fresh waters even if later, like the Eiders, they become sea birds. SCHILLER (1954) has found that in the Yukon district, young Spectacled eider, *Arctonetta fisheri* (Brandt), Emperor geese, *Philacta canagica* (Sevaszianoff) and Cackling geese, *Branta canadensis minima* Ridgway are much more heavily infested on the breeding grounds than are the adult birds when they arrive, in the Spring, to nest. It seems as if the birds eliminate the greater part of their parasites as they become adult.

The tapeworms from Eider ducks and the Long-tailed duck do not differ from those of other anserines that never go near the sea and it is obvious that the birds must become infested on the breeding grounds only or, eventually, when migrating overland. This appears also to be the case for trematodes and in particular, for Strigeids that never occur in birds living exclusively at sea[1]).

The occurrence in West Greenland gulls of two distinct species

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[1]) In a Sanderling from South Africa, we have found besides *H. nitida* (see page 43) the larval form of which occurs probably in freshwater or land snails, the trematodes *Himasthla leptosoma* (Creplin, 1829) and at least two genera and species of *Microphallidae*. These trematodes are known to occur in marine mollusks and crustaceans. This example shows how birds, when migrating, are liable to pick up their food in very different biotopes and also indicates that the Sanderling does not necessarily follow a land route.

belonging to the genus *Anomotaenia* also reported from Antarctic gulls, is particularly interesting as other bird groups also harbour this genus and where the life cycles are known, the intermediate hosts are either freshwater or terrestrial invertebrates (Myriapods, Snails or Oligochaetes). It is therefore necessary to admit that there must also be some marine invertebrate included in the life cycle or that gulls would be able to find land snails or insects when foraging along the sea shore. Yet should this be possible in the case of gulls, it would not explain how Guillemots acquire their species of *Anomotaenia*. We must therefore conclude that in this tapeworm genus, intermediate hosts may be either terrestrial, freshwater or marine.

There should be more emphasis on this type of research and fresh material, collected in the field and well preserved, should be carefully examined. This is necessary in order to obtain a better view of tapeworm taxonomy and its bearing on host relationships as the present classification is based, in greater part, on material from museums some of which is more than one hundred years old. Under the circumstances, it is not surprising that mistakes have been made due to the fragmentary state and bad preservation of the specimens and also to faulty host identifications and to incorrect and illegible labels.

List of hosts with their parasites.

Pisces.

Elasmobranchia.

Somniosus microcephalus (Bl. Sch.).
Monorygma perfectum (Van Beneden, 1853).
Raja radiata Donovan.
Pseudanthobothrium hanseni n. gen., n. sp.

Teleostei.

Gadus callarias L.
Echinorhynchus gadi Zoega in Müller, 1776.
Abothrium gadi (Van Beneden, 1871).
Gasterosteus aculeatus L.
Schistocephalus solidus (Müller, 1776).

Aves.

Procellariiformes.

Fulmarus glacialis (L.).
Stegophorus stellae-polaris (Parona, 1901).
Tetrabothrius minor (Loennberg, 1893).
Tetrabothrius procerus Spätlich, 1909.

Charadriiformes.

Alcae.

Cepphus grylle (L.).
Tetrabothrius jägerskiöldi Nybelin, 1916.
Anomotaenia campylacantha (Krabbe, 1869).

Uria lomvia Brünn.
Anomotaenia armillaris (Rudolphi, 1819).
Anomotaenia meinertzhageni n. sp.

Alca torda L.
Tetrabothrius jägerskiöldi Nybelin, 1916.

Lari.

Larus hyperboreus Gunn.
Tetrabothrius erostris (Loennberg, 1899).
Anomotaenia larina (Krabbe, 1869).
Hymenolepis ductilis Linton, 1927.

Larus glaucoides Mayer.
Tetrabothrius cylindraceus (Rudolphi, 1819).
Tetrabothrius erostris (Loennberg, 1899).
Anomotaenia micracantha (Krabbe, 1869).
Hymenolepis ductilis Linton, 1927.

Rissa tridactyla L.
Tetrabothrius erostris (Loennberg, 1899).
Anomotaenia larina (Krabbe, 1869).

Sterna paradisea Pontopp.
4 specimens from the Kronprinsens Ejland were free of parasites.

Charadrii.

Lobipes lobatus (L.).
7 specimens from Mudderbugten and Grönne Ejland all found free of parasites.

Erolia maritima (Brünn.).
Arythmorhynchus distinctus n. sp.
Echinoparyphium groenlandicum n. sp.
Dilepis megalorhyncha (Krabbe, 1869) n. comb.
Arctotaenia tetrabothrioides (Loennberg, 1890) n. gen.

Crocethia alba (Pallas).
Hymenolepis nitida (Krabbe, 1869).

Arenaria interpres (L.).
2 specimens from Grönne Ejland both negative.

Anseriformes.

Clangula hyemalis (L.).

Apatemon gracilis minor (Yamaguti, 1933).
Haploparaxis groenlandica (Krabbe, 1869).
Hymenolepis coronula (Dujardin, 1845).

Somateria spectabilis (L.).

1 specimen from Disko Bugt had no parasites.

Passeriformes.

Calcarius lapponicus (L.).

1 specimen examined without parasites from Godhavn.

Mammalia.

Carnivora.

Canis familiaris L. Eskimo dog.

2 dogs examined were found free of tapeworms.

DESCRIPTION OF SPECIES

NEMATODA

Acuaridae Seurat, 1913.

Stegophorus stellae-polaris (Parona, 1901), Wehr, 1934.

Syn. *Histiocephalus stellae-polaris* Parona, 1901.
Streptocara stellae-polaris (Parona, 1901), Skrjabin, 1916.
Yseria stellae-polaris (Parona, 1901), Gedoelst, 1919.

This species appears to be relatively rare in adult Fulmars, *Fulmarus glacialis* L. but occurs however, in large numbers, in the crop of young birds taken at the nest from the Disko fjord colony. As is the case for tapeworms, the parent birds must feed their young with large quantities of the unknown intermediate host since it is unlikely, that the worms in the gizzard of adult birds would be disgorged with the food into the crop of the chicks.

This species was originally reported from Cape Säulen on the West coast of Nova Zemlya[1]). It has been found by Baylis (1928) in the North Sea Fulmar and by Wehr (1934) in Fulmars taken at sea South of Danmarks Strædet as well as in Brünnich's Guillemot off the East coast of Greenland at Lat. N. 72.00 and 73.00 respectively. It is for the first time to our knowledge, that it is reported from West Greenland.

The genus *Stegophorus* Wehr, 1934, based upon Parona's species, is characterized by the presence of two shield-like structures that enclose the head region and are contiguous on both the dorsal and the ventral sides. The free edge of each shield is denticulate, there being 20–28 triangular teeth arranged symmetrically on either side of a longitudinal axis. The ventral and dorsal borders of the shield are thickened and end in a flat, rose-thorn shaped spine (fig. 2). The two head shields are mobile and no doubt anchor the worm in the crop-wall when they spread out.

The two pseudolabia each bear two small papillae (fig. 3). The cervical papillae are tricuspid, the median prong lying in a different

[1]) Both Cram (1927) and Wehr (1934) appear to have overlooked Parona's paper published in 1903 giving these indications together with a drawing of the worm.

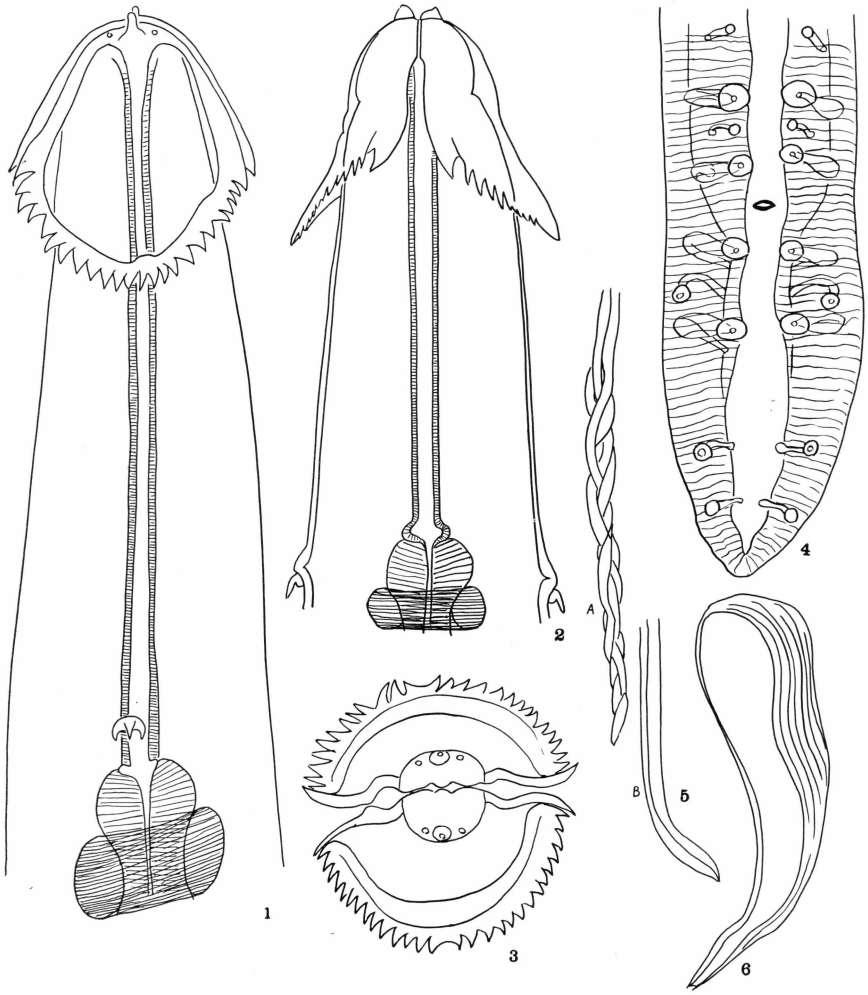

Fig. 1—6. *Stegophorus stellae-polaris* (Parona): 1. Head of female in lateral view. 2. Head of male in ventral view. 3. Head seen *en face*. 4. Caudal extremity of male showing the cloacal papillae. 5. Longer spicule showing, A the "plaited" portion, B the distal extremity. 6. Shorter spicule.

plane to the two lateral ones. There is a very long, chitinous, vestibule that joins the muscular portion of the pharynx just behind the cervical papillae. The nerve ring lies close behind the juncture of the vestibule with the pharynx.

Female: The length is 12—16 mm and the diameter of unflattened worms is 148 μ. The distance from the anus to the tip of the tail is 200 μ. The vestibule is 200 μ long and the anterior portion of the pharynx, 511 μ long and 20—25 μ in diameter. The posterior, glandular portion

of the pharynx is 1.4 mm in length and 35—45 μ in diameter. The cervical papillae are located at 204 μ from the anterior end. The vulva lies in the posterior half of the worm at about 7 mm from the head. The thick-shelled eggs containing a larva measure 44 μ by 24 μ.

Male: The length is 5—6 mm and the diameter, 102 μ. The vestibule measures 190 μ in length and the anterior, muscular portion of the pharynx, 400 μ by 15—20 μ in diameter. The cervical papillae are 180 μ distant from the head. The caudal alae are supported by 9 pairs of papillae, 4 preanal and 5 postanal (fig. 4). The 2nd, 4th, 5th and 7th pairs have a peculiar structure that has been reported for the first time by JOHNSTON & MAWSON (1942 a). They are toadstool-shaped and appear to be very characteristic for this group of nematodes. The two spicules are very unequal and also differ considerably in their respective shapes. The narrow spicule is 1.6—2.4 mm long and near its distal extremity, has a very characteristically plaited structure, ending in a smooth, narrow, scoop (fig. 5). The shorter spicule measures 65—100 μ in length and its distal extremity is always curved ventrally (fig. 6).

The above description agrees in most points with WEHR's (*loc. cit.*) diagnosis of this species. The female worms, in our specimens, are somewhat longer, whereas the males are about 50 per cent shorter. On the other hand, both of the spicules are slightly longer in our specimens than in WEHR's. Finally, this author states that the nerve ring is near the equator of the muscular pharynx, but this must be a slip, since in all the species belonging to this genus, it lies close to the anterior end of the pharynx. Such small differences are not sufficient for establishing a new species, all the more so that in many of the Antarctic species, the males are unknown.

It is interesting to find that the genus *Stegophorus* has a bipolar distribution since it occurs in Antarctic Puffins, Petrels and Albatrosses as well as in Penguins.

S. diomedeae (Johnston & Mawson, 1942) (= *Paryseria diomedeae* J. &. M.), *S. pachyptilae* (Johnston & Mawson, 1942) (= *Paryseria pachyptilae* J. & M.) and *S. heardi* Mawson, 1954 from Albatrosses and Petrels, are the only Antarctic species from Procellariformes in which the male is known. In none of these is found the curious plaited structure of the longer spicule. The male of *S. macronectes* (Johnston & Mawson, 1942) (= *Paryseria macronectes* J. & M.) is unknown.

In *S. adeliae* (Johnston, 1937) (= *Paryseria adeliae* J.) and *S. paradeliae* Johnston & Mawson, 1945, from Penguins the male of the latter species only has been described (Mawson, 1954). JOHNSTON & MAWSON (1945) based their key to the species both on the position occupied by the cervical papillae and on the number of spines on the head shields. These characters may be accepted provisionally until all the male

worms have been described, since it seems that the number of cloacal papillae and the structure of the spicules are less variable than the number of spines on the head shields.

ACANTHOCEPHALA

Echinorhynchidae Hamman, 1892.

Echinorhynchus gadi Zoega in Müller, 1776.

This worm, characteristic of Cod-fish, was collected in large numbers from a Cod, *Gadus callarias* L. at Ritenbenk (6.VIII.55) and at Godhavn. It has previously been reported from Greenland by E. Wesenberg-Lund (1926) from the Godthaab district.

Arythmorhynchus (?) distinctus n. sp.

Only two immature specimens, a male and a female, were collected from a Purple Sandpiper, *Erolia maritima* (Brünn.) at Mudderbugten (3.VIII.55).

The female measures 2 mm in length and 730 μ in diameter, whereas the male is 1.8 mm long and 823 μ in diameter. A distinct constriction separates the base of the proboscis from the body and, here, the diameter is 457 μ only. The proboscis is 457 μ in length with a diameter of 160 μ. It is armed with sicteen longitudinal rows of hooks containing five hooks each. The latter vary in length; the first two hooks measure, respectively 54 μ and 59 μ, whereas the three following hooks are all 48 μ long. The rostellar sack is 548 μ in length with double walls and the ganglion lies near the middle of the proboscis. Unfortunately, in both of the specimens, the proboscis is partly retracted into the anterior swelling which is beset with numerous fine spines. The lemnisci are rather long and cylindrical.

In the male, the two testes, located in the anterior half of the body, measure respectively 180 μ and 125 μ in length. We are unable to state the exact number of cement glands; there appear to be only four(?).

In spite of our species being juveniles, they may be attributed to the genus *Arythmorhynchus* Lühe, 1911, two species of which, *A. eroliae* (Yamaguti, 1939) and *A. comptus* Van Cleave & Rausch, 1950 have been previously reported from palearctic Sandpipers. *A. eroliae* from *Erolia alpina sakhalina* (Vieill.) from Japan, and *A. comptus* from *Erolia alpina pacifica* (Vieill.), *E. ptilocnemis couesi* (Ridgway) and *Aphriza virgata* (Gm.) from Alaska.

A. distinctus n. sp. can be separated from these species by the number and arrangement of the hooks upon the proboscis. It possesses the smallest

number of hooks (5) per longitudinal row of all the known species according to a recent review of VAN CLEAVE & RAUSCH (1950).

In the list of Acanthocephala from Greenland published by E. WESENBERG-LUND (1926) there are only five records from birds *viz. Echinorhynchus hystrix* Bremser from *Phalacrocorax carbo* (L.) and *Mergus serrator* L., *Echinorhynchus polymorphus* Bremser (= *Polymorphus minutus* (Goeze)) from *Somateria mollissima* (L.) and *Clangula hyemalis* (L.), *Echinorhynchus alcae* (O. F. Müller) from *Alca torda* L., *Echinorhynchus micracanthus* Rud. from *Oenanthe oenanthe* L. and *Echinorhynchus inflatum* Creplin from *Erolia alpina* (L.), *Crocethia alba* (Pallas) and *Haematopus ostralegus* L.

E. hystrix belongs to the genus *Corynosoma* Lühe, 1905 and is usually considered a synonym of either *C. semerme* (Forssall, 1904) or of *C. strumosum* (Rudolphi, 1802). VAN CLEAVE (1953) has shown that both of these species occur in sea mammals and also, *C. semerme*, accidentally in Cormorants. Yet since another closely related and as yet undescribed species is usually found in Cormorants, the specific status of the Greenland parasites from this host remains open to doubt.

Echinorhynchus alcae (= *Fillicollis anatis* (Schrank, 1788)) has never again been reported from the Razorbill since found in this host by FABRICIUS. The attribution of *E. alcae* to *F. anatis* is doubtful.

Echinorhynchus micracanthus Rudolphi, 1819 (= *Mediorhynchus micracanthus* (Rud.)) occurs very frequently in passerine birds. It has been reported from the Jakobshavn district in the Wheatear, *Oenanthe oenanthe* (L.).

Echinorhynchus inflatus Creplin reported from the Sanderling, the Dunlin and the Oyster-catcher, probably belongs to the genus *Arythmorhynchus* and it is quite likely that it is identical with one of the above mentioned species. The original description is however insufficient to warrant any sort of synonymy.

TREMATODA

Echinostomatidae Dietz, 1909.

Echinoparyphium groenlandicum n. sp.

A few specimens were collected from a Purple Sandpiper, *Erolia maritima* (Brünn.) at Mudderbugten (4.VIII.55). Only one of three birds examined harboured these parasites. The length of the worms varies from 1.8 mm to 2 mm. The greatest width measured across the ventral sucker, is 274—320 μ whereas in the posterior half of the worm, the width is 183—229 μ. The oral sucker measures 73 μ by 79,5 μ. The characteristic collar is 183 μ broad and bears 36 spines. The four spines,

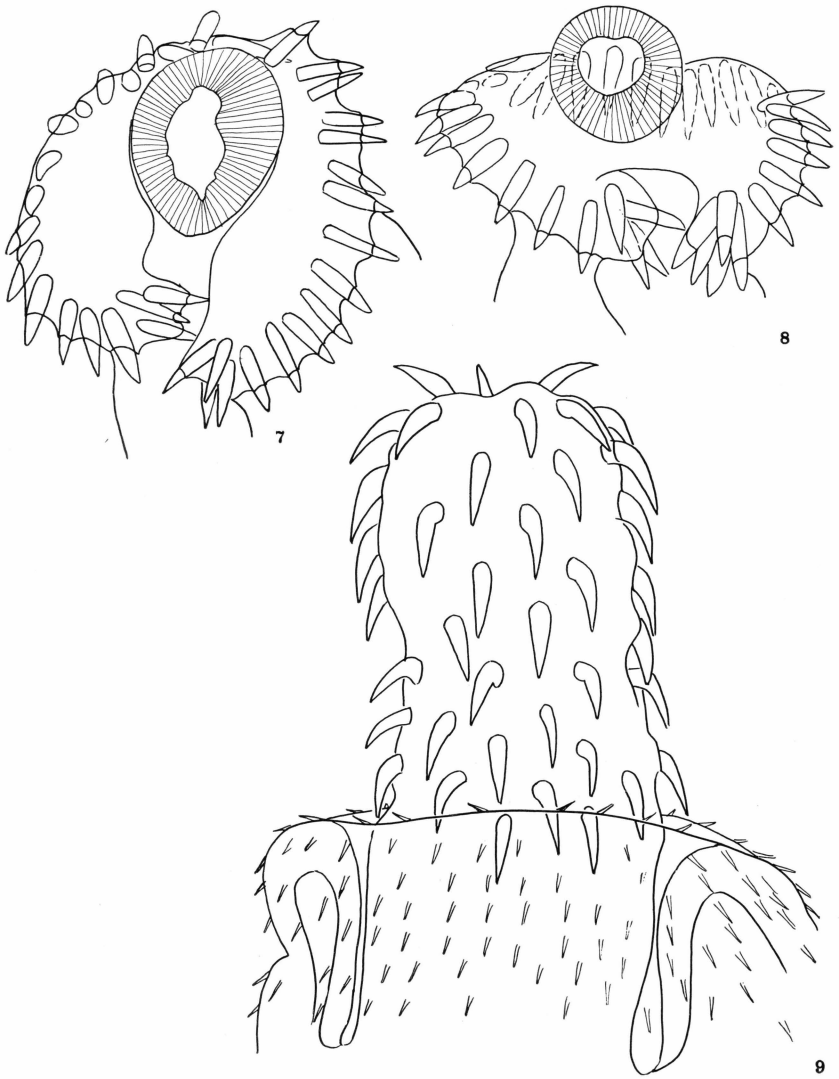

Fig. 7—9. 7—8. *Echinoparyphium groenlandicum* n. sp.: Two aspects of the spine-bearing collar.

9. *Arythmorhynchus* (?) *distinctus* n. sp. Partly evaginated proboscis of a young female worm.

located ventrally at each end of the collar, are larger than the others. In each of these groups, the smallest spine is 34—36 μ long and 7—9 μ wide and the largest spines, 41—45 μ long and 9—11 μ wide. All the other spines vary in length from 37 to 39 μ. The pharynx measures 68 μ in diameter and is 73 μ in length. There is a short prepharynx and a long oesophagus that bifurcates immediately in front of the ventral

sucker. The latter measures 159—160 μ in diameter and is about 240 μ deep (dorso-ventral). It is situated at the junction of the first and second quarters of the body. The entire dorsal surface of the worm is armed with rather heavy spines that are deeply embedded in the cuticule and are arranged in longitudinal rows. In all of our specimens, the anterior quarter of the worm is bent ventrally. The genital pore is situated immediately in front of the ventral sucker. The vagina is thick-walled and the cirrus poch measures 230—270 μ by 114 μ. It contains a large *vesicula seminalis*, a *pars prostatica* and an unarmed cirrus. The ovary is larger than either of the testes, measuring 82—114 μ in diameter. It is pressed against the anterior testis, which is itself, pressed against the posterior testis. The anterior testis measures 69 μ in length by 137 μ in width and the posterior testis is only 90 μ long and 101 μ in diameter. The faily short uterus contains a small number of very large eggs measuring 80—89 μ by 48—50 μ. Some even measure 96 μ by 64 μ. The vitellaria consist of large follicles reaching as far as the ovary and, when the worms are much contracted, to the posterior border of the ventral sucker. Immediately behind the posterior testis, the follicles meet both ventrally and dorsally on the mid line.

According to MENDHEIM (1943) and to BYCHOWSKAIA-PAVLOWSKAIA (1953) the genus *Echinoparyphium* Dietz, 1909 contains fifteen species thirteen of which occur in birds. None of the species described appear to possess 36 spines and among those that have either 35 (*E. agnatum* Dietz, 1909) or 37 (*E. aconiatum* Dietz, 1909, *E. paraulum* (Dietz, 1909), *E. politum* Skrjabin, 1915), none have the same characters as those described above.

E. groenlandicum n. sp. appears to be most nearly related to *E. aconiatum*, a species recorded from Lapwings. It differs however from the latter, in number and size of the spines, size of the eggs and distribution of the vitellaria. Pending a more satisfactory classification of the family *Echinostomatidae*, we prefer to consider our species as distinct from all those described so far.

Strigeidae Railliet, 1919.

Apatemon gracilis minor (Yamaguti, 1933).

More than 50 specimens of this trematode were collected from the anterior portion of the gut of a Long-tailed Duck, *Clangula hyemalis* (L.) at Mudderbugten (2.VIII.55). The largest specimen measured 715 μ in length with a maximum diameter of 325 μ. The oral sucker is 113.5—119 μ in diameter; the pharynx 32 μ by 50 μ and the ventral sucker, 137 μ in diameter. The ova are very large, 93—104 μ long and 66—73 μ in diameter. These measurements agree with those from the original

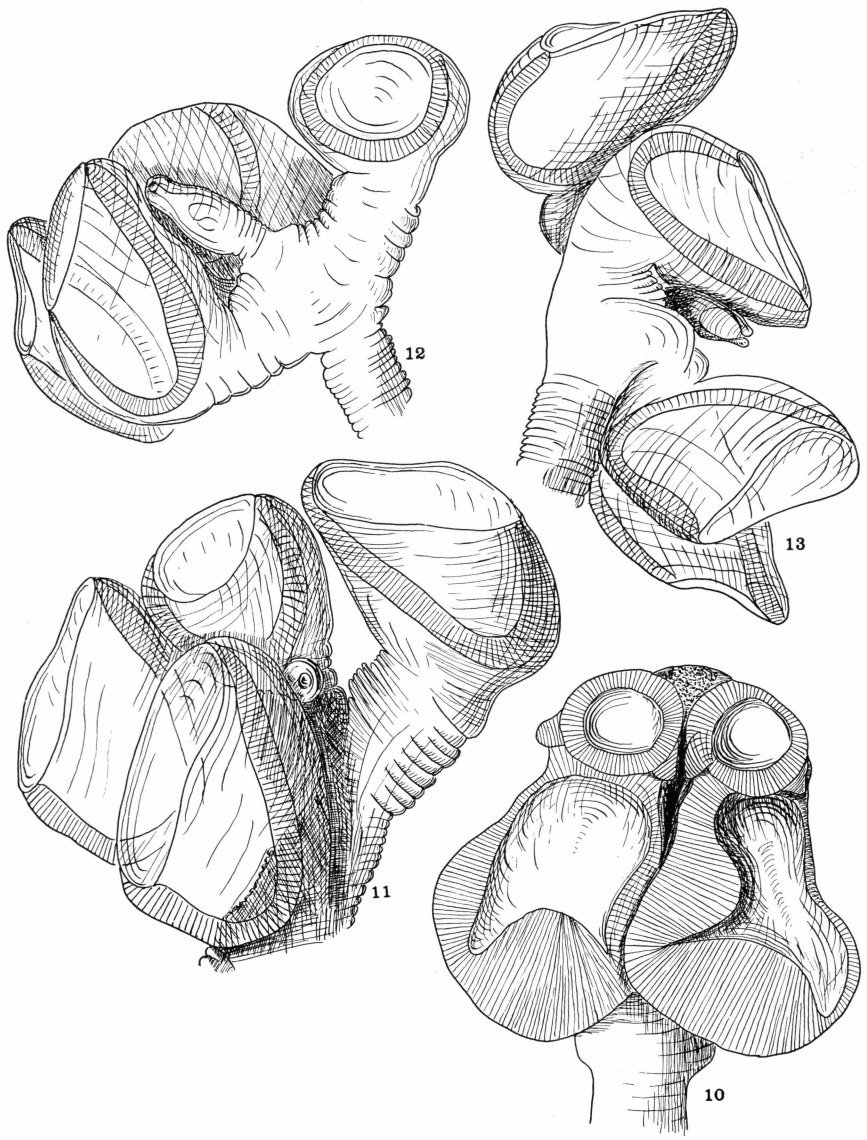

Fig. 10—13. 10. *Monorygma perfectum* (Van Beneden): Scolex *in toto* with the apical, glandular, mass, clearly visible.

11—13. *Pseudanthobothrium hanseni* n. gen. n. sp. Different aspects of the scolex with contracted myzorhynchus (11) and with this organ fully extended (12—13).

description of *A. minor* Yamaguti, 1933. This species for which the above host is new, has been reduced to subspecific rank by Dubois (1953).

It is interesting to recall that *A. gracilis* (Rudolphi, 1819) has been reported from anserine birds exclusively. This species has been split

up into ten subspecies that appear to be, mostly, local or host variations. Curiously enough, their life-cycles, where known, may be grouped into two distinct categories according to whether the second intermediate host is a vertebrate (fish) or an invertebrate (leech, snail(?)). One would, therefore, expect to find the adult worms corresponding to the first group, in diving ducks and those of the second group, in surface ducks, geese and swans. Since this is not the case however, it would seem that the chances for ecological segregation do not exist and that conditions that might favour subspeciation, are lacking. Under the circumstances, one must question the opportunity of establishing subspecies or even varieties in taxonomic groups such as these especially when there appears to be definite proof that the same species may have either a vertebrate or an invertebrate as second intermediate host. All the cercariae that correspond to *A. gracilis*, have been reported from freshwater snails and the metacercariae from freshwater fishes and leeches. This implies that sea ducks such as the Eiders and Long-tailed ducks can only become infested when breeding in the tundra, or, accidentally, when migrating inland over freshwater lakes.

We collected freshwater snails, *Limnaea vahli* Möll.[1]) from the tundra at Mudderbugten, but none of these were infested with sporocysts or cercariae.

CESTODA

Tetraphyllidea

Phyllobothriidae Braun, 1900.

Monorygma perfectum (Van Beneden, 1853)

Syn. *Monorygma chlamydoselachi* Loennberg, 1898.
Phyllobothrium sp. Zschokke, 1903.
Phyllobothrium magnum Hart, 1936.
Monorygma maquariae Johnston, 1937.

This tapeworm is characteristic for the Greenland Shark, *Somniosus microcephalus* (Bl. Sch.) taken at Godhavn (25.VII.55). Of five specimens examined, every one harboured these worms[2]). The degree of infestation of the sharks appears to be high, as we have observed pieces of strobila pass through the anus of other sharks that were being removed from the baited hooks while still in the water.

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[1]) We thank Dr. J. BINDER of the Natural History Museum in Geneva for identifying these snails.

[2]) In the stomach of one of these sharks, we found two specimens of *Lycichthys minor* (Olafs.), a large and still recognizable portion of *Eumicotremus spinosus* (Müll.) and beaks of cephalopods.

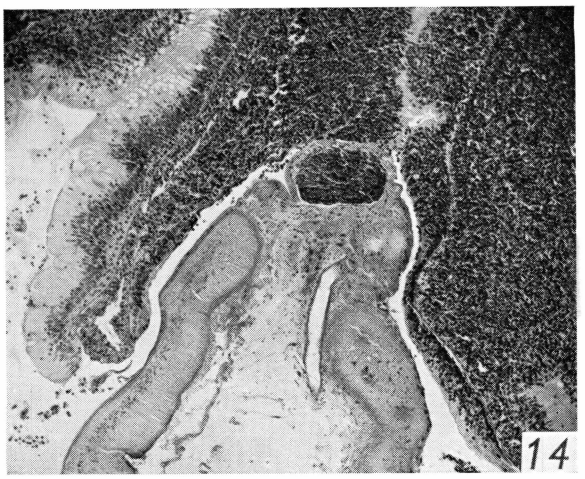

Fig. 14. *Monorygma perfectum* (Van Beneden): Section passing through a scolex *in situ* showing the host's tissue reaction and the deeply staining glandular mass in the apical region of the scolex. Two bothridia only are visible since the section passes between the four apical suckers.

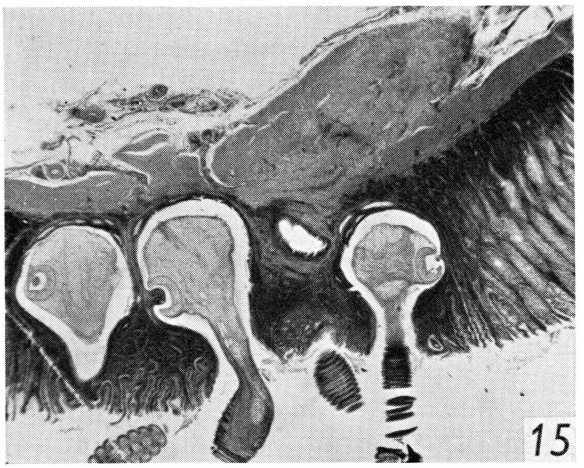

Fig. 15. *Anomotaenia meinertzhageni* n. sp.: Scolices implanted in the gut-wall of BRÜNNICH's Guillemot.

Our specimens are 350 mm long when preserved, with a maximum width of 4 mm. The scolex measures 1.8 mm in length and 1.3 mm across the anterior suckers. It bears four circular suckers about 580 μ in diameter each of which is provided with two small muscular papillae on the posterior border of the sucker (fig. 10). Immediately behind these suckers are four large bothridia that are very mobile in the living state and rather shallow. The apex of the scolex is occupied by a mass of deeply staining, uncellular glands which is clearly visible on whole mounts and

that bears no relationship to a myzorhynchus or any similar structure. The eggs, removed from the living worm, are spindle-shaped and measure 155 μ by 40 μ.

It is particularly interesting to record the fact that this same species of tapeworm has been collected from a shark cast up on the beach at Maquarie Island in the Antarctic (JOHNSTON, 1937). The host was determined provisionally as *Somniosus sp.* and no further information appears to be available concerning it. The genus *Somniosus* Gill is known from the Arctic only and one must suppose that a specimen of this deep-sea shark might have migrated through the cold, deep, waters beneath the equator into the Antarctic.

Pseudanthobothrium hanseni n. gen., n. sp.[1])

Syn. *Anthobothrium cornucopia* Heller, 1949 *nec* Van Beneden, 1850.
Echeneibothrium minimum Rees, 1953 *nec* Van Beneden, 1850.

Several specimens of this small tapeworm were collected from a Skate, *Raja radiata* Donovan brought up by the trawl of the *Dana III* from a depth of 340 m in Disko Bugt (5.VIII.55).

None of the specimens are gravid nor is the uterus developed. The largest worm is about 4 mm long and consists of 40 segments. The maximum width of the strobila is 250 μ. The scolex is extremely polymorph, bearing four stalked bothridia (fig. 11—13), each of which forms a cup-shaped organ of varying depth according to the degree of contraction. A pedunculated myzorhynchus, about 55 μ in diameter, occupies the apex of the scolex and when this is contracted, appears to be a sucker (fig. 11).

The detailed description of the internal anatomy has been recently published by REES (1953). This author ascribed her specimens obtained from *Raja clavata* L. off the coast of Iceland, to *Encheneibothrium minimum* Van Beneden. The latter species, however, possesses bothridia with loculi as are also found in other species of *Echeneibothrium.* HELLER (1949) reported from *Raja scabrata* Garman, under the name of *Anthobothrium cornucopia* Van Beneden, specimens that undoubtedly belong to our species, since *A. cornucopia* has never been recorded from Skates but only from Sharks. Moreover, *R. scabrata* is very closely related to *R. radiata.*

The diagnosis of the genus *Pseudanthobothrium* n. gen. will be: Phyllobothriids having a scolex with a pedunculated myzorhynchus and very polymorph, stalked, bothridia that are never divided by loculi. Each bothridium forms a cup-shaped organ. Genital pores in the posterior

[1]) This species is dedicated to Dr. P. M. HANSEN of the Danish Fisheries Ministry, in appreciation of his enthusiasm and for his indefatigable cooperation during the "long day" we spent on board the *Dana III.*

half of the segment. Testes large and relatively few, all anterior to the cirrus pouch. Yolk glands lateral in two continuous bands of large follicles. Parasites of *Batoidea.*

Type species: *Pseudanthobothrium hanseni* n. sp.

Tetrabothrioidea

Tetrabothriidae Braun, 1900.

All of the species mentioned below have been recently redescribed (Baer, 1954).

Tetrabothrius minor (Loennberg, 1893).

This species always occurs in very large numbers in all the Fulmars. We have found it every time in 25 *Fulmarus glacialis* (L.) examined from the Diskofjord region (VII—VIII.55). The worms can be so abundant that the entire lumen of the gut is filled with them.

It is interesting to note that all the Fulmars contained beaks of cephalopods in their stomachs and that these were also found in young Fulmars, still upon the nest and also harbouring this tapeworm.

Tetrabothrius procerus Spätlich, 1909.

This species is much less frequent in Fulmars than the preceeding one. We have found it occasionally in Fulmars from Disko Bugt. It is very closely related to the above species but can be easily distinguished by the larger number of testes 15—21 *contra* 6—12.

Tetrabothrius erostris (Loennberg, 1899).

Collected from Kittiwakes, *Rissa tridactyla* L. at Ivnaq (6.VIII.55), from an Iceland Gull, *Larus glaucoides* Mayer at Oqaitsoq (6.VIII.55) and from a Glaucous Gull, *Larus hyperboreus* Gunn. at Mudderbugten (3.VIII.55). It is one of the most characteristic tapeworms of Gulls throughout the World. We have also found it in chicks of Kittiwakes at Ivnaq, but no cephalopod beaks were observed in the stomachs of either the young or the adult birds.

Tetrabothrius cylindraceus (Rudolphi, 1819).

This species, somewhat smaller than the above, has been collected, only once, from an Iceland Gull, *Larus glaucoides* Mayer at Oqaitsoq, in which it occurred together with *T. erostris.*

Tetrabothrius jägerskiöldi Nybelin, 1916.

This typical parasite of the *Alcae* was discovered in one of four Razorbills, *Alca torda* L. at Oqaitsoq (6.VIII.55).

Pseudophyllidea

Amphicotylidae Nybelin, 1922.

Abothrium gadi Van Beneden, 1870.

A single, incomplete, specimen of this worm was collected from a Cod, *Gadus callarias* L. at Ritenbenk (6.VIII.55). It has been recorded before from Greenlandic waters and occurs frequently in Cod although we did not observe it in the fishes from Disko Bugt.

Diphyllobothriidae Lühe, 1910.

Schistocephalus solidus (Müller, 1776).

We found this larval tapeworm in about 60 % of the Stickelbacks, *Gasterosteus aculeatus* L. in a lake situated between Jakobshavn and the Jakobshavns Isfjord (8.VIII.55). The parasitized fishes, their bellies distended, could be easily caught by hand.

FABRICIUS already reported this larval tapeworm from the same region in 1780 but the adult worm does not appear to have been reported from Greenland. It is very likely that the final host will be the Black-throated Diver, *Gavia arctica* (L.) that nests upon these lakes and of which we saw and heard a single bird as we traveled along the lake shore.

Cyclophyllidea

Dilepididae Fuhrmann, 1907.

Anomotaenia armillaris (Rudolphi, 1810).

Syn. *Taenia alcae* Fabricius, 1780.
Taenia tordae Fabricius, 1780.
Taenia alcae-picae Goeze, 1782.
Taenia armillaris Rudolphi, 1810.
Taenia socialis Krabbe, 1869 *nec* Retzius, 1786.
Anomotaenia tordae (Fabricius, 1780), Fuhrmann, 1908.
Anomotaenia sociabilis Ransom, 1909.

Several specimens of this species were collected from BRÜNNICH's Guillemot, *Uria lomvia* L. at Ivnaq (7.VIII.55). Two birds were examined but one only was found harbouring tapeworms. These were deeply implanted in the intestinal mucosa and all around the site of implantation

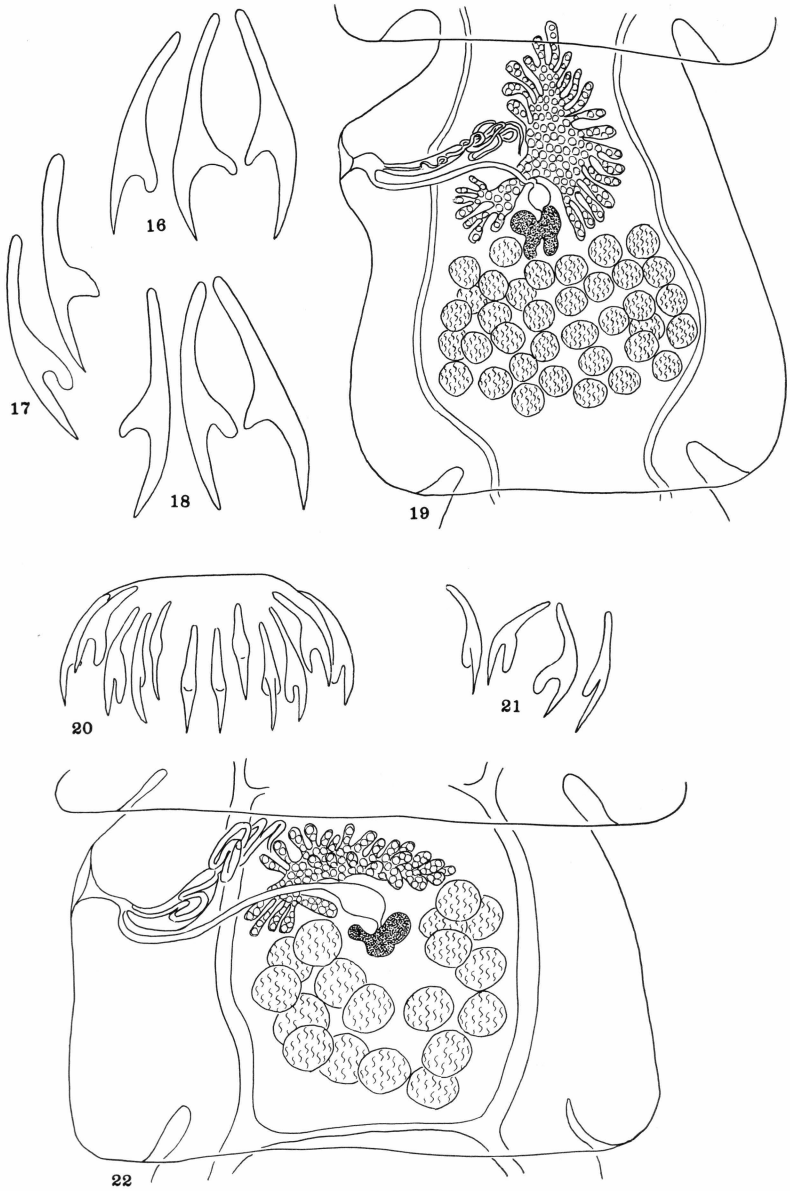

Fig. 16—22. 16—19. *Anomotaenia armillaris* (Rudolphi): 16. Rostellar hooks drawn from KRABBE's type of *T. socialis*[1]). 17. Rostellar hooks from the present specimens. 18. Rostellar hooks from KRABBE's type of *T. armillaris*. 19. Anatomy of an adult segment.

20—22. *Anomotaenia campylacantha* (Krabbe): 20. Rostellum showing the peculiar implantation of the hooks. 21. Rostellar hooks. 22. Anatomy of an adult segment.

[1]) All the rostellar hooks in the following figures are drawn to the same scale.

the mucosa was coloured a bright red owing to its being injected with blood.

Before describing this tapeworm that does not appear to have been found again since KRABBE first reported it, it will be necessary to establish its list of synonyms. There exists a great confusion with regards to the correct name that should be applied to this worm. According to KRABBE (1869), FABRICIUS described what he considered to be two distinct species from *Alca pica* Faber (= *Uria lomvia* L.), under the respective names of *Taenia alcae* Fab. and *T. tordae* Fab. Neither of these species is recognizable and they should be considered as *nomina nuda*. Later, RUDOLPHI (1810) renamed *T. tordae*, *T. armillaris* Rud. and it is under the latter name that KRABBE (*loc. cit.*) has published the first valid description. FUHRMANN, however (1908) lists the worm under *Anomotaenia tordae* (Fab.) syn. *T. armillaris* Rud. and gives the host as being *Alca torda* L.! The same error occurs in the second edition of his work on bird tapeworms (1932). We have compared KRABBE's original slides of *Taenia socialis* Krabbe *nec* Retzius, renamed *Anomotaenia sociabilis* Ransom, with our own material, and find that this species is also a synonym of *A. armillaris*.

The mode of attachment to the intestinal mucosa seems to be characteristic of this species and has also been observed by KRABBE for his material from *Uria troile* L. collected in Iceland and in the Faroës. The scolex is deeply embedded in the gut wall so as to be completely enclosed, a slight swelling corresponding to the point of implantation being visible on the peritoneal surface of the gut. Although the mucosa remains intact, there is a marked tissue reaction in the immediate vicinity of the scolex, and the entire submucosa is invaded by large numbers of lymphocytes. The pathological reaction is that of a chronic state that has evolved slowly and is in keeping with a case of normal parasitism.

Our largest specimen measures 42 mm in length, but since there are no gravid segments, the length must be greater. KRABBE found 130 mm for *T. socialis* but his material is badly macerated. The maximum width of the strobila is 2 mm. The scolex is 540 μ in diameter and each of the suckers measures 229 μ. The rostellum bears a double crown of 20 hooks that measure, respectively, 46 μ and 41 μ (fig. 17). KRABBE found in *T. socialis* 20—24 hooks, 46 μ and 35—42 μ in length, and in *T. armillaris*, 25 hooks, 43 μ in length. We have drawn KRABBE's hooks to the same scale as those from our material and see no reason to consider *T. armillaris* as distinct from *T. socialis* (fig. 16, 18).

The genital pores alternate irregularly. There are 33—40 testes per segment, all of which lie posterior to the female glands. The cirrus pouch is rather long and narrow, measuring 204—274 μ in length and

37—41 μ in diameter. It contains an unarmed cirrus as well as several coils of the *vas deferens*. The latter is much coiled outside the cirrus pouch. The vagin opens into the well-marked genital atrium at right angles to the cirrus pouch (fig. 19). It is thick-walled with a narrow lumen that dilates rather suddenly to form a *receptaculum seminis*. The ovary is deeply lobed and consists of two distinct "wings" the poral one of which is the smaller. The eggs, measured from KRABBE's material of *T. socialis* from *Uria troile* L., are 80 μ in diameter and contain an embryo measuring 41 μ in diameter.

Anomotaenia campylacantha (Krabbe, 1869).

The specimens were collected from Black Guillemots, *Cepphus grylle* (L.) at Diskofjord (27.VIII.55) where each of the 3 birds examined harboured the parasites. Two other specimens of Black Guillemots, collected on the Kronprinsens Ejland (20.VIII.55) were negatif. This tapeworm has been previously reported, from the same host, from the Jakobshavn district (PFAFF) and also from the Faroës, but its anatomy has never been described.

The length of the worms is 50—60 mm and the greatest width 1.5 mm. The scolex measures 250 μ in diameter and each of the circular suckers, 109 μ. The rostellum is 147 μ in length with a diameter of 57—67 μ. It bears a double crown of 30 hooks, 21—22 μ long. The hooks are not implanted in two regular rows since the anterior row is formed by each third hook (fig. 20). The genital pores alternate irregularly and lead into a distinct genital atrium. The thick-walled cirrus pouch measures 114—137 μ in length and 23—25 μ in diameter. It contains an unarmed cirrus and several coils of the *vas deferens*. The latter also forms a number of coils outside the cirrus pouch. To the proximal extremity of the latter, there is attached a retractor muscle. There are 15—20 large testes grouped behind the female genitalia, each testis having a diameter of 54 μ. The thick-walled vagina opens into the genital atrium behind the cirrus pouch. Its proximal extremity is dilated to form a *receptaculum seminis*. The ovary is distinctly lobed and lies somewhat closer to the poral half of the segment. The uterus is reticulated when it first appears, but as soon as the eggs begin to fill it out, the network is effaced, leaving a sack-like organ somewhat lobed at its outer surface. The eggs are 38—41 μ in diameter and the enclosed embryo measures 32 μ.

Anomotaenia meinertzhageni n. sp.

Syn. ? *Anomotaenia micracantha* Fuhrmann, 1908 *nec* Krabbe, 1869.

Several specimens of this new species were collected from BRÜNNICH's Guillemot, *Uria lomvia* L. at Oqaitsoq (7.VIII.55).

The scolices of these worms were deeply embedded in the intestinal mucosa and were preserved *in situ* (fig. 15, pag. 19). Our first impression, based on this mode of implantation, was that we were dealing with *A. armillaris* from the same host. There exist, however, constant and very distinctive characters by which the two species can be separated without any difficulty. The length of our specimens is 80 mm and the greatest width, 1.6 mm. The scolex measures 970 μ to 1 mm in diameter. It bears four very large, oval, suckers that measure 325 μ by 358 μ. The rostellum is relatively small, 69 μ in diameter. The rostellar hooks appear to be arranged in a double crown. It is likely that the hooks fall out when the scolex is embedded within the intestinal mucosa since all of the scolices that were dissected out from the gut had a small number of hooks. These are normally small, 24—25 μ in length and we estimate their number as being at least 14—16. The rostellum is contained in a rostellar sack that also encloses many, deeply staining, glandular cells.

The genital pores alternate irregularly and are situated in the first quarter of the segment. There are 53—56 testes all of which are situated behind the female genitalia. The cirrus pouch is 160—182 μ in length and 32—40 μ in diameter. At its proximal extremity there is attached a powerful, bifid, retractor muscle. The cirrus is unarmed. The ovary and the yolk gland are almost entirely situated in the poral half of the segment (fig. 23). The uterus is at first reticulate but soon fills out into a lobed, sack-like structure. The ovoid embryophores measure 37 μ by 29 μ. They are enclosed in a very thin outer membrane that is very easily torn, this appearing to be a normal process.

We have placed as a synonym of the above species a cestode mentioned by FUHRMANN (1908) under the name of *A. micracantha* (Krabbe, 1869) that seems to have been reported from a Black Guillemot. We have however failed to trace this reference definitely and believe that there must have arisen some confusion between KRABBE's species that occurs normally in Gulls and *A. meinertzhageni* n. sp. from the Black Guillemot. Both of these worms have a large scolex with powerful suckers and a relatively small rostellum. In both species, also, the hooks are nearly of the same size. *A. micracantha* (Krabbe, 1869) has been recently redescribed by SCHILLER (1951) and by JOYEUX & BAER (1954).

The species of *Anomotaenia* described from Guillemots are obviously closely related and appear to have evolved within this group of hosts. It is interesting to find that at Oqaitsoq, BRÜNNICH's Guillemot harbours *A. armillaris* whereas the same host taken at Ivnaq, about 15 km distant, harbours *A. meinertzhageni* n. sp. Should this not be due to a coincidence, it would show that these bird colonies are considerably segregated.

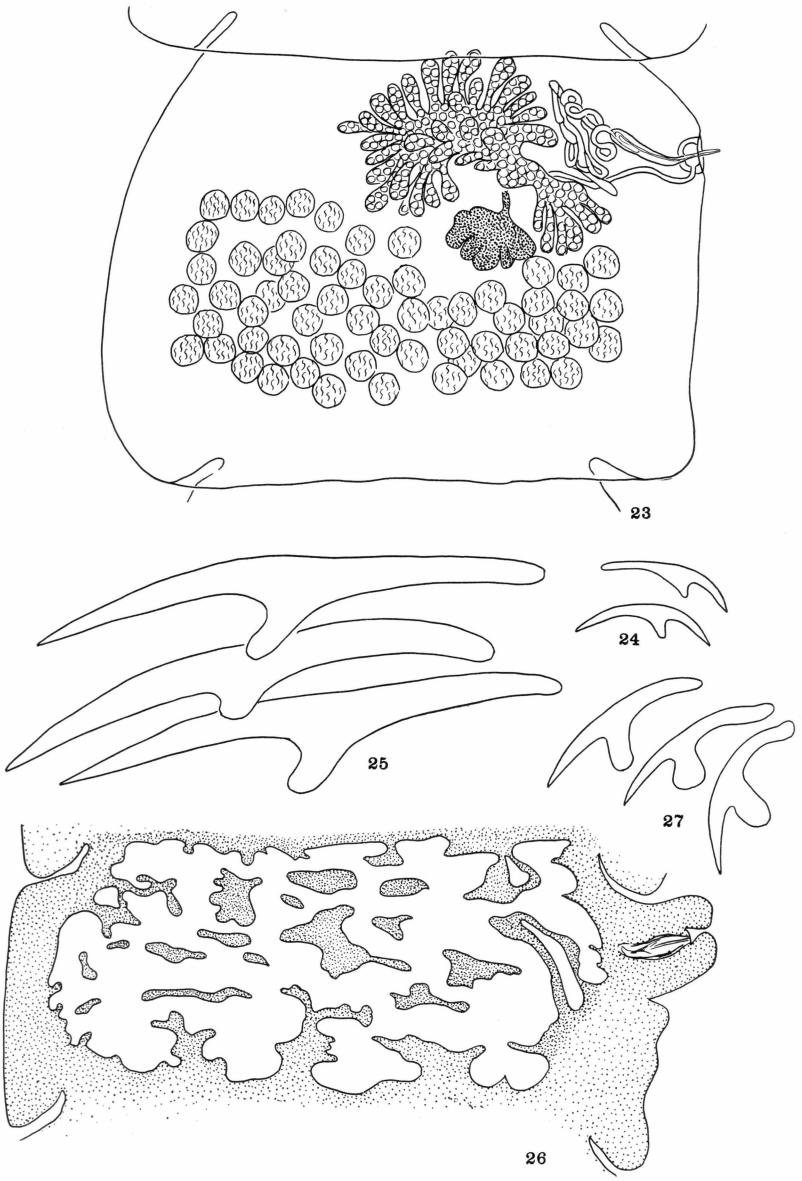

Fig. 23—27. 23—24. *Anomotaenia meinertzhageni* n. sp.: 23. Anatomy of an adult segment. 24. Rostellar hooks.

25—26. *Anomotaenia larina* (Krabbe): 25. Rostellar hooks. 26. Section of a gravid segment showing the ramified uterus.

27. *Anomotaenia micracantha* (Krabbe), rostellar hooks.

The presence in arctic Guillemots of tapeworms that have their scolices deeply buried in the host's intestinal wall has also its counterpart in the Antarctic where the cestode *Parorchites zederi* (Baird, 1853) is

found attached in a similar fashion to the gut of Penguins. *P. zederi* was formerly relegated to the genus *Anomotaenia* but differs from this genus in that the female genitalia lie close to the genital pore, although the testes form a single, transverse, field, behind the female glands. We have seen above, that *A. meinertzhageni* n. sp. also differs from the other species of the genus *Anomotaenia* in that the female glands are located in the poral half of the segment and also, that the proglottides are broader than long. This might imply a relationship between *A. meinertzhageni* n. sp. and *P. zederi* two tapeworms that are segregated respectively in the Arctic and in the Antarctic in distinct host groups, that occupy similar biological niches but that are not, apparently, related to one another.

Anomotaenia larina (Krabbe, 1869).

This species was found in two Kittiwakes, *Rissa tridactyla* (L.) at Ivnaq (6.VIII.55) and in a Glaucous Gull, *Larus hyperboreus* (L.) at Mudderbugten (3.VIII.55). Although recently redescribed by SCHILLER (1951) and by JOYEUX & BAER (1954), we think that a short description is necessary to draw attention to the greater limits of variation of certain measurements and organs. JOYEUX & BAER's description was based upon KRABBE's original material from Iceland that he had presented to FUHRMANN. Since this material is in a bad state of preservation, this may account for some of the differences with the present collection. We have tabulated the principal characters below and also added the data from SCHILLER's recent description.

	KRABBE, 1869	JOYEUX & BAER, 1954	SCHILLER, 1951	Present material
Length mm	30	—	80	40
Width mm	2.5	—	3	1
Scolex μ	—	450	500	334—390
Suckers μ	—	197/200	216	183/142
Hook number	20—22	20—22	20—22	23
Hook size μ	100—110	96—108	96—110	105—109
No. of testes	—	16—20	30—40	25—30
Cirrus pouch	—	266—274	240—288	274
Eggs μ	—	46/54	32—36	36—39/25—30

The present specimens are 40 mm long and have a maximum width of 1 mm. The scolex measures 334—390 μ in diameter and the oval suckers, 183 μ by 142 μ. The rostellum is 90—100 μ in diameter and bears 23 hooks 105—109 μ long. The genital atrium is protrusible

and, when everted, appears as a large sucker on the lateral border of the proglottid (fig. 26). The thick-walled cirrus pouch is 274 μ long and 41 μ in diameter and contains an unarmed cirrus. The genital ducts pass dorsally to both of the longitudinal excretory vessels and the vagin passes to the dorsal side of the cirrus pouch but opens into the genital atrium behind the male pore. The uterus is distinctly reticulated and only becomes sack-like in the gravid segments. The eggs measure 36—39 μ by 25—30 μ.

From the comparative table of measurements taken from different sources, it is clear that this species presents more variation than might have been expected. The number and size of the hooks, however, appear to be almost constant and this is also true for their shape. On the other hand, the great differences in the size of the scolex may be due to the time elapsed between the death of the host and conservation of the worms. SCHILLER's specimens are almost twice as long as our own and three times as wide. He observes 30—40 testes in regard to 25—30 in our specimens. He also states that the genital ducts pass between the dorsal and the ventral excretory vessels an arrangement that occurs in the related species *A. micracantha* (see below) but not in our specimens. KRABBE's material from Iceland has 16—20 testes only. This would imply that in the same species of tapeworm, the number of testes, per segment, is liable to vary by 100 per cent! Before admitting so great a variation, it will be necessary to collect more material from Arctic Gulls in order to establish the possible existence of subspecies of tapeworms. In this respect, it should be noted that SCHILLER's specimens were collected from the Pacific Kittiwake, *Rissa tridactyla pollicaris* Ridgway.

Anomotaenia micracantha (Krabbe, 1869).

Specimens without gravid segments were collected from an Iceland Gull, *Larus glaucoides* Mayer at Oqaitsoq (6.VIII.55). Their length is 80—95 mm and their width 823 μ. The scolex measures about 400 μ in diameter and the oval suckers, 137—160 μ by 200—206 μ. The rostellum is 229 μ in length and 64 μ in diameter where the hooks are attached. The latter, 20—21 in number are 25—26 μ long. Contrary to most of the other species belonging to the genus *Anomotaenia*, the genital ducts pass between the dorsal and the ventral longitudinal excretory vessels. The cirrus pouch is 148—159 μ long and 32—36 μ in diameter. There are 13—18 testes all of which are situated behind the ovary and the yolk gland. The walls of the vagina are very muscular. The eggs measure 68 μ in diameter and the enclosed embryo, 45 μ by 39 μ.

This description tallies with that given by SCHILLER (*loc. cit.*) whose material was obtained from the Pacific Kittiwake. The rostellar hooks

are slightly smaller than those from KRABBE's material collected from Greenland Kittiwakes.

Anomotaenia borealis (Krabbe, 1869), Fuhrmann, 1908.

Syn. *Taenia borealis* Krabbe, 1869.
Choanotaenia borealis (Krabbe, 1869), Clerc, 1906.

This species from the West Greenland Snow Bunting, *Emberizia nivalis* (L.) has been described by KRABBE (1869) who gave an excellent drawing of the hooks seen under different angles. CLERC (1906) reported this worm in the Yellowhammer, *Emberizia citrinella* L. and in the Wagtail, *Motacilla alba* L. from the Urals.

We have been able to examine both the types and cotype material from the KRABBE collection and have observed that there are certain differences when compared to CLERC's description. The cotype material is fragmentary and the widest segments measure 550—900 μ in width. A single scolex is 206 μ in diameter and the circular suckers measure 79 μ across. Unfortunately the rostellar hooks have fallen out, but we have found KRABBE's original slide from which his drawings were made. There are 18 hooks arranged in two rows respectively 30 μ and 23 μ in length. The shape of the hooks is identical to that of the original drawing. CLERC was under the impression that KRABBE had been dealing with two species that had been included together in the same tube. This is, however, not the case but KRABBE having drawn hooks from different angles has clearly shown how their shape varies under these circumstances.

The internal structure also differs somewhat from that described by CLERC whose figures are given in brackets. There are 16—20 (*ca.* 12) testes and the cirrus pouch measures 136—204 μ by 57—45 μ (170 μ). It contains a large cirrus, heavily armed with hooklets. The vagina is thick-walled and lies immediately behind the cirrus pouch. The uterus appears to be reticulate and the eggs measure 37—39 μ in diameter and the embryo, 28—30 μ.

It is possible that when more material has been examined the species described by CLERC will be given subspecific rank but for the time being, we consider it as a variation of *A. borealis* Krabbe.

Dilepis megalorhyncha (Krabbe, 1869) n. comb.

Syn. *Taenia megalorhyncha* Krabbe, 1869.
Hymenolepis (?) *megalorhyncha* (Krabbe, 1869), Cohn, 1901.
Drepanidotaenia megalorhyncha (Krabbe, 1869), Lopez-Neyra, 1942.

The worms were collected from a Purple Sandpiper, *Erolia maritima* (Brünn.) from Grönne Ejland (9.VIII.55). Only one bird out of three

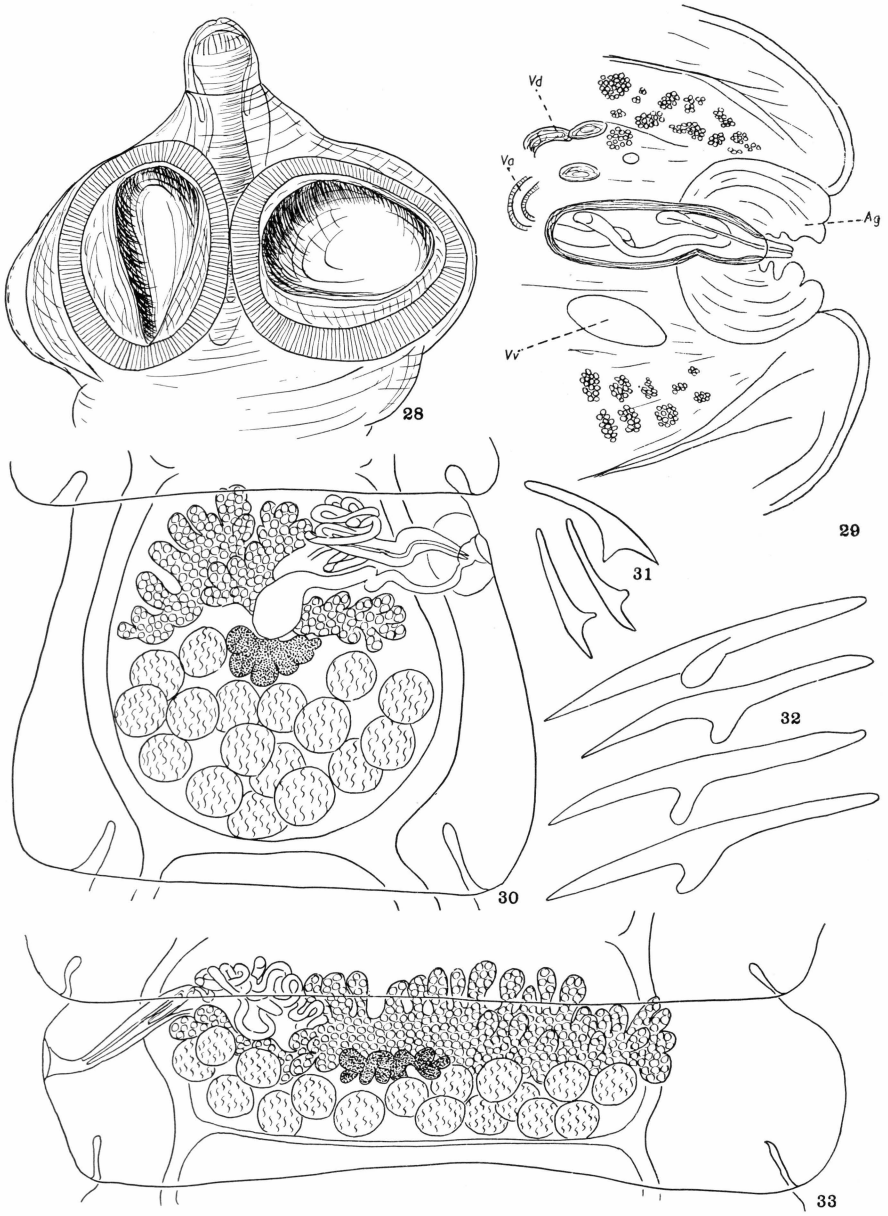

Fig. 28—33. 28—29. *Anomotaenia micracantha* (Krabbe): 28. Scolex. 29. Section through the genital atrium; Ag: muscular genital atrium; Va: vagina; Vd: *vas deferens*; Vv: ventral longitudinal excretory vessel. 30. Anatomy of an adult segment.

31. *Anomotaenia borealis* (Krabbe), rostellar hooks drawn from the original co-type material.

32—33. *Dilepis megalorhyncha* (Krabbe): 32. Rostellar hooks. 33. Anatomy of an adult segment.

from this region haboured these worms. The single specimen is 33 mm long and has a maximum width of 730 μ. The scolex is about 550 μ in diameter and the oval suckers measure 252 μ by 183 μ. The rostellum bears a double crown of 18 hooks that are 71—73 μ long but the tips of the hooks are almost on a single circle. The genital pores are unilateral and the long and narrow cirrus pouch measures 160—176 μ and has a diameter of 23 μ. It contains an apparently unarmed cirrus and also several coils of the *vas deferens*. The latter is much coiled outside the cirrus pouch. There are 17—19 large testes situated behind the female genitalia in two rows. The ovary is very broad and stretches across the segment, even passing beyond the aporal excretory vessels. The vitelline gland is relatively small, much lobed, and is situated somewhat to the poral side of the ovary. Unfortunately, neither the uterus nor the eggs were present in our material.

The number, size and shape of the rostellar hooks correspond to KRABBE's description and drawings of *T. megalorhyncha* a species that was collected from the identical host in the Jakobshavn district. Until this day, the worm has been considered as having a doubtful status and it has been listed by FUHRMANN (1932) under *Taenia s. l.* Although our specimens are not gravid, there appears to be no doubt whatever as to assigning them to the genus *Dilepis* of which eleven species have been described from Charadriiformes, *viz. D. capellae* Yamaguti, 1935, *D. fuhrmanni* Railliet & Henry, 1909, *D. hamasigi* Yamaguti, 1940, *D. irregularis* Southwell & Lake, 1939, *D. limosa* Fuhrmann, 1907, *D. nymphoides* Clerc, 1903, *D. ochropodis* Neslobinsky, 1911, *D. odhneri* Fuhrmann, 1909, *D. recapta* Clerc, 1906, *D. retirostris* (Krabbe, 1869), *D. tringae* Cholodkowsky, 1912.

D. hamasigi is, obviously, identical with *Trichocephaloides megalocephala* (Krabbe, 1869) and becomes a synonym of the latter. It should be removed from the genus *Dilepis*[1]).

D. recapta possesses an unarmed and rudimentary rostellum and probably does not belong to the genus *Dilepis* (see below).

D. capellae and *D. irregularis* are identical and occur both in the same host. Priority must be given to the name *irregularis* so that *capellae* becomes a synonym of the latter.

D. retirostris (Krabbe, 1869), Zschokke, 1903 was originally reported by KRABBE from the Turnstone in Greenland and also in Eastern Germany as well as from the Dunlin in the Faroës. KRABBE gave an excellent drawing of the rostellum and of the hooks, but to this day no description of the internal anatomy has been published. We have had

[1]) According to CLERC, *T. megalocephala* has about 18 testes. However, in cotypes in our collection, there are only 8—10. YAMAGUTI describes 8 testes in *D. hamasigi*.

the good fortune to be able to examine KRABBE's original slides as well as cotype material and furnish a new description of this worm below.

D. tringae might just as well be considered a *nomen nudum.* The description is inadequate and the rostellar hooks, only 10 μ long are strongly reminiscent both in shape and size of those belonging to the tapeworm *Choanotaenia cingulifera* (Krabbe, 1869) that also occurs in numerous Charadriiformes.

D. ochropodis has hooks 43 μ long. Their number is not stated but their shape is peculiar and distinct from any species described so far in the genus *Dilepis.*

Of the remaining species mentioned above, *D. limosa* and *D. nymphoides* both possess 20 rostellar hooks that measure, respectively, 99—110 μ and 56—62 μ. *D. limosa* has an extremely long cirrus pouch (790 μ) that enables one to distinguish this species from all of those described from Charadriiformes. The shape of the hooks of *D. nymphoides* is stated by CLERC (1903) as similar to that of *T. paradoxa* Krabbe, 1882 *nec* 1869[1]). This would imply that the blade of the hooks of *D. nymphoides* is more curved than it is in *D. megalorhyncha.*

D. odhneri has 20—30 rostellar hooks that differ in shape from those of *D. megalocephala* and this is also the case for the hooks of *D. fuhrmanni* which has 32 hooks the first row of which is 64 μ long and 30 μ in the second.

Consequently, *D. megalorhyncha* (Krabbe, 1869) is a distinct species of which the internal structure is described here for the first time.

Acanthocirrus retirostris (Krabbe, 1869) n. comb.

Syn. *Dilepis retirostris* (Krabbe, 1869), Zschokke, 1903.
Acanthocirrus macrorostratus Fuhrmann, 1907.
Gryporhynchus macrorostratus (Fuhrmann, 1907), Ransom, 1909.

Hosts: *Erolia alpina* (L.), *E. maritima* (Brünn.), *Arenaria interpres* (L.)

Of this species, we have examined KRABBE's original material deposited in the Royal Veterinary College in Copenhagen, slides from material in the Vienna and Berlin museums and the types of FUHRMANN's *Acanthocirrus macrorostratus.* Since all these specimens collected from the above hosts are identical, we must accept the rather startling conclusion that the anatomy of "*Dilepis*" *retirostris* has been described by FUHRMANN (1907) nearly fifty years ago but under another name and from a wrong host![2])

[1]) KRABBE (1869) redescribed and gave drawings of the hooks of *T. paradoxa* Rudolphi. In a second paper (1882) he describes under the same name, a species of which the size and shape of the hooks are different.

[2]) We have recently found another specimen collected from a Turnstone by Mr. D. R. R. BURT at St, Andrews (Scotland).

FUHRMANN's material was supposed to have been collected from a Meadow Pipit, *Anthus pratensis* L. and was described under the name *Acanthocirrus macrorostratus* n. sp. this species being made the type of a new genus. Subsequently, RANSOM (1909) advanced the opinion that the genus *Acanthocirrus* Fuhrmann was a synonym of *Gryporhynchus* v. Nordmann on the basis that in both genera large spines occur near the base of the cirrus. However, in the type of this genus *viz. G. macropeus* Wedl (= *cheilancristrotus* (Wedl)) the spines are independant of the cirrus pouch and also, the shape of the rostellar hooks is very characteristic and quite different from the usual shape. It is therefore necessary to revive the genus *Acanthocirrus* Fuhrmann, 1907 for *T. retirostris* Krabbe, 1869. This is possible, from a nomenclatural standpoint since the original type, *A. macrorostratus* has been found to be identical with the type specimens of *T. retirostris.*

The length of this species varies from 30 to 45 mm and the greatest width, 500 to 800 μ. The scolex measures 230 μ in diameter and each of the suckers, 90 μ. The rostellum is 57 μ in diameter at its base but at its distal extremity, where the hooks are attached, its diameter is 100 μ. There are 20—22 hooks arranged in a double crown, and their length varies from 70 to 75 μ (fig. 34). The shape and size of the rostellar hooks of *A. macrorostratus* agree in all details with the present description.

The genital pores are unilateral and the genital ducts pass between the longitudinal excretory vessels. The longitudinal musculature is very powerfully developed and consists of two layers of bundles the inner ones of which are the largest and contain about 12—15 fibres each. The outer bundles are much smaller and contain only 5—6 fibres. There are 8—11 large testes grouped together in the posterior half of the segment, between the excretory vessels. The cirrus pouch in normally contracted segments, is 159—170 μ long with a diameter of 48 μ. In much relaxed and rather macerated segments, the length of the cirrus pouch is 275 μ and its diameter, 45 μ. The walls of the cirrus pouch are muscular and enclose several loops of *vas deferens* and a large cirrus that bears, at its distal extremity, two very long spines that measure 40—57 μ. The base of the spines is broadly triangular and is attached to the cirrus proper (fig. 39). When the cirrus is completely invaginated into the pouch it is found that the two larges spines are located at some distance from the base of the cirrus and also that numerous, finer, spines becoming larger as they approach the big spines, occupy the base of the male organ. It would seem, from our specimens, that the spined portion corresponds to the cirrus proper *i. e.* to the portion that will be everted and, consequently, that the two large spines are the most distally placed upon the cirrus (fig. 36).

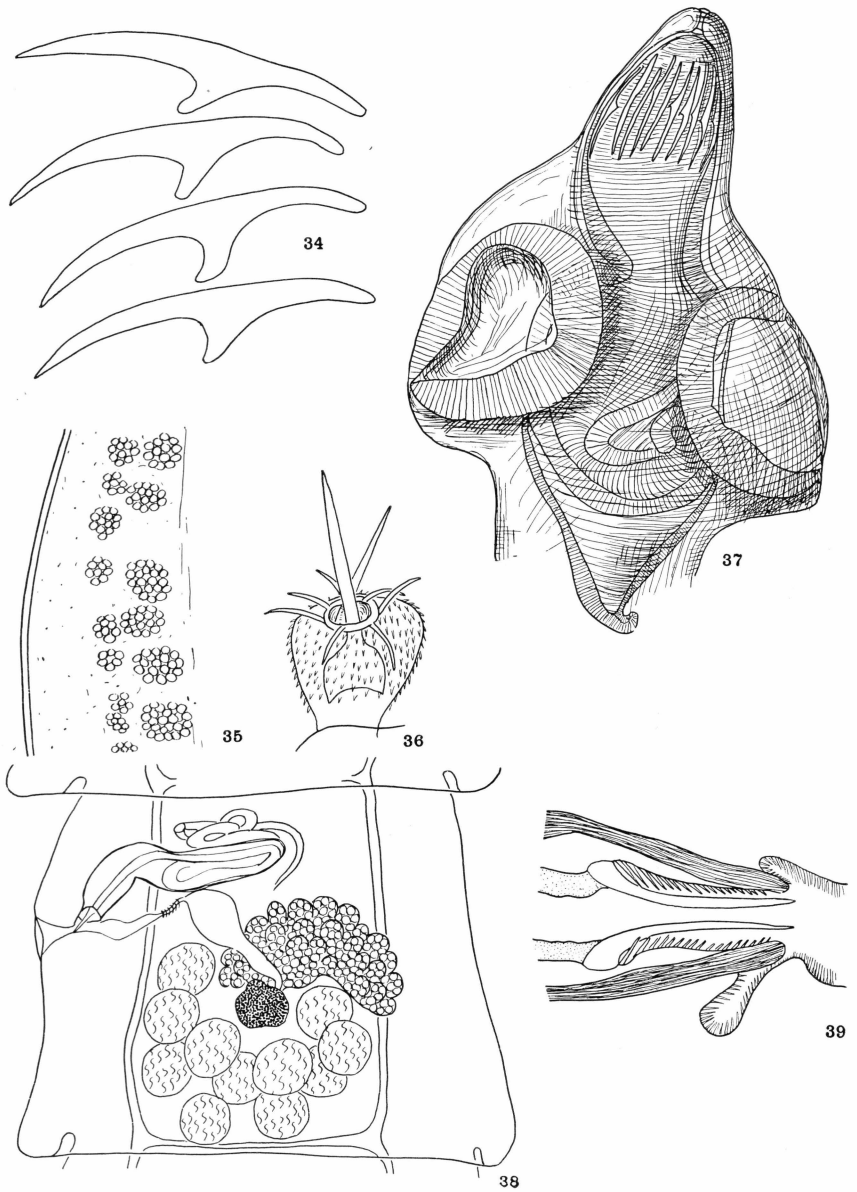

Fig. 34—39. *Acanthocirrus retirostris* (Krabbe): 34. Rosteliar hooks. 35. Portion of a transverse section showing the powerful longitudinal muscle bundles. 36. Extremity of an evaginated cirrus with the two large spines. 37. Scolex with retracted rostellum. 38. Anatomy of an adult segment. 39. Longitudinal section of an invaginated cirrus showing position of the spines.

The vagina opens into the genital atrium posterior to the cirrus pouch and its distal portion forms a kind of funnel the narrow end of which is surrounded by circular muscle fibres. Immediately after this portion, the vagin is dilated into a *receptaculum seminis*. Ovary and yolk

gland lie anterior to the testes. The uterus is sack-like and the eggs measure 39 μ in diameter, and the embryo, 25 μ.

The diagnosis of the genus *Acanthocirrus* Fuhrmann, 1907 will be:

Dilepidinae with a double crown of rostellar hooks of nearly equal size. Genital pores unilateral; genital ducts passing in between the longitudinal excretory vessels. Testes few, situated behind the female glands. Cirrus pouch containing a peculiar armed cirrus with two large, flat, spines. Uterus sack-like. Parasites of Charadriiformes.

Type species: *A. retirostris* (Krabbe, 1869).

Arctotaenia n. gen. **tetrabothrioides** (Loennberg, 1890).

Syn. *Taenia tetrabothrioides* Loennberg, 1890.

Several specimens of this worm were collected from a Purple Sandpiper, *Erolia maritima* (Brünn.) at Mudderbugten (2.VIII.55). Only one bird out of three was parasitized. Purple Sandpipers from Grönne Ejland, on the other hand, harboured different species of tapeworms.

The length of our specimens is 25—35 mm and their greatest width, 1 mm. The globular scolex measures 270—320 μ in diameter and the large, rounded suckers, 148—193 μ. The latter are sometimes oval 148 μ long and 125 μ wide. There is no trace of a rostellum although the apex of the scolex is sometimes protruded to form a conical process. The genital pores are unilateral and the genital ducts pass in between the longitudinal excretory vessels. On transverse sections, it is found that the dorsal excretory vessel on the poral side, is much displaced towards the center of the proglottid, whereas on the aporal side, it is found to be lateral to the ventral vessel (fig. 43). The longitudinal muscles consist of rather indistinct layers of small bundles each containing 3 to 4 fibres.

The cirrus pouch is long and very narrow and passes at its proximal end beyond the poral excretory vessels. Its length is 160—204 μ and its diameter 9—18 μ only. The very narrow cirrus is 5 μ in diameter and appears to be unarmed. There are 25—30 testes all of which are posterior to the female glands. The vagina is thick-walled and much coiled. It is rather suddenly dilated to form a *receptaculum seminis*. The ovary occupies the entire width of the parenchyma and the somewhat lobed yolk gland is situated slightly to the poral side of the ovary. The uterus appears at first as a small sack, ventral to the ovary but it soon branches out and passes laterally beyond the excretory vessels. The eggs with a thick embryophore, measure 33 μ by 26 μ and the enclosed embryo is 22 μ by 17 μ.

There appears to be no doubt about this species being the same as that described by LOENNBERG (1890) from a Dunlin in Western Norway.

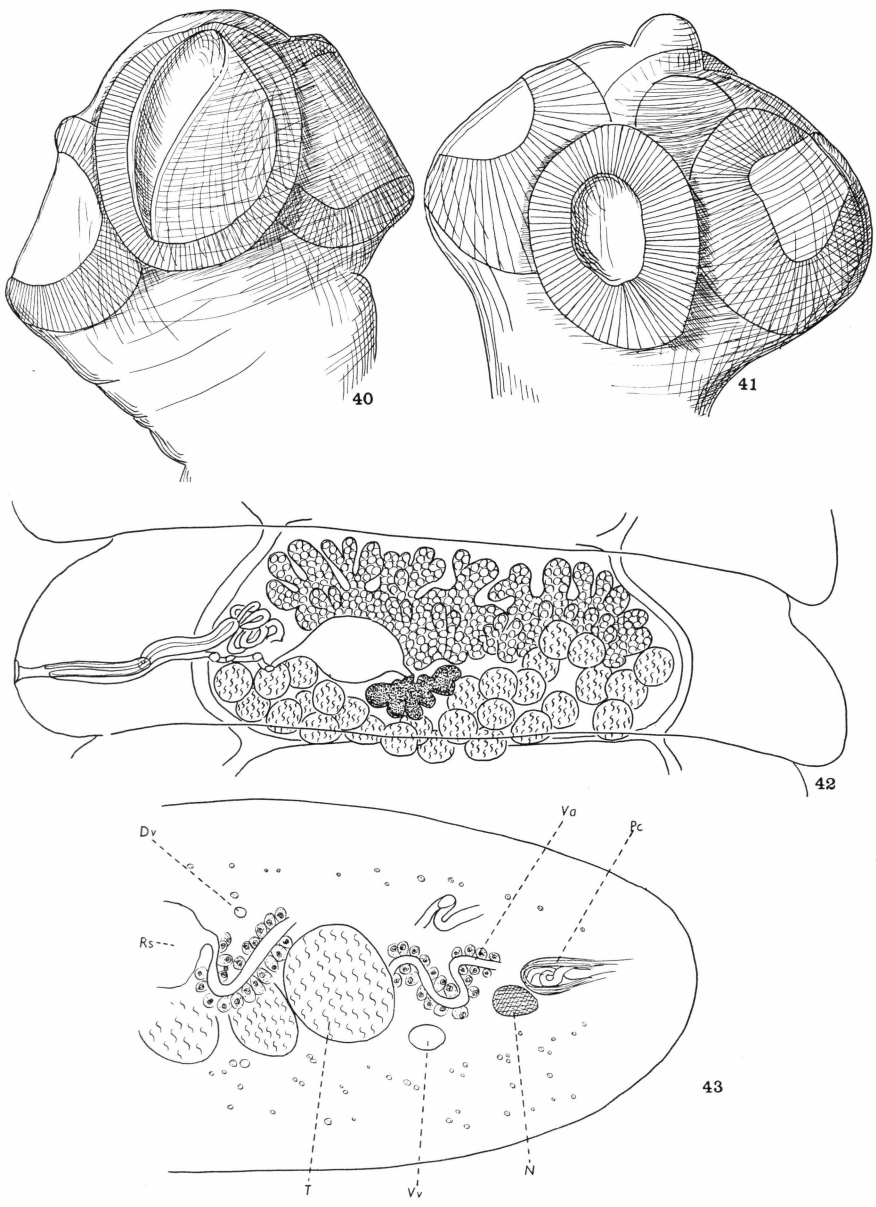

Fig. 40—43. *Arctotaenia* (n. gen.) *tetrabothrioides* (Loennberg): 40. Scolex without any trace of a "rostellum". 41. Scolex showing the protracted condition of the apex ressembling a rostellum. 42. Anatomy of an adult segment. 43. Poral half of a transverse section through an adult segment: Dv: dorsal longitudinal excretory vessel; N: longitudinal nerve; Pc: cirrus pouch; Rs: receptaculum seminis; T: testis; Va: vagina surrounded by glandular cells; Vv: ventral longitudinal excretory vessel.

It has not been reported since from the palearctic region. It might be supposed that the tapeworm described under the name *Dilepis recapta* Clerc, 1906 and possessing a rudimentary rostellum might be conspecific with the above species. This worm was collected from a Little Stint, *Erolia minuta* (L.) in the Urals. It is however clear from CLERC's description that his specimens have a much smaller cirrus pouch and also fewer testes. The longitudinal musculature of *D. recapta* is very strongly developed.

The absence of a rostellum make it necessary to remove *D. tetrabothrioides* and also *D. recapta* from the genus *Dilepis* and to erect a new genus for which we propose the name *Arctotaenia* n. gen. with the following diagnosis:

Dilepidinae with an unarmed scolex and no rostellum. Genital pores unilateral; genital ducts passing in between the longitudinal excretory vessels. Female genitalia in anterior half of segment and testes in posterior half. Uterus thin-walled, sack-like, later lobed and passing ventrally beyond the longitudinal excretory vessels. Adults in Charadriiformes.

Type species: *A. tetrabothrioides* (Loennberg, 1890) n. comb.

Further species: *A. recapta* (Clerc, 1906) syn. *Dilepis recapta* Clerc, 1906.

Hymenolepididae Fuhrmann, 1907.

Haploparaxis groenlandica (Krabbe, 1869) n. comb.

Syn. *Hymenolepis groenlandica* (Krabbe, 1869), Fuhrmann, 1906.

The specimens were collected from a Long-tailed Duck, *Clangula hyemalis* (L.) at Mudderbugten (3.VIII.55). They are 11 mm long with a maximum width of 780 μ. The scolex with rostellum retracted, is 229—297 μ in diameter and with the rostellum fully evaginated, 277 μ. The suckers are usually oval, 91—98 μ by 84—136 μ. The rostellum measures 120 μ in length and has a diameter of 146—160 μ. The rostellar pouch is 215 μ in length. The rostellum bears a single row of 10 hooks 41—42 μ long. Their shape is identical to that given by KRABBE although the hooks in our specimens are slightly longer since KRABBE stated their length as being 38 μ.

The cirrus pouch is 160—200 μ long and 30—32 μ in diameter. It almost reaches the aporal longitudinal excretory vessels and the cirrus is unarmed. The single large testis has a diameter of 102 μ (fig. 45) the eggs are 37 μ in diameter.

KRABBE's original material was collected from the same host and also from the Disko Bugt region. It has never been redescribed before but was placed into the genus *Hymenolepis* by FUHRMANN (1906) on

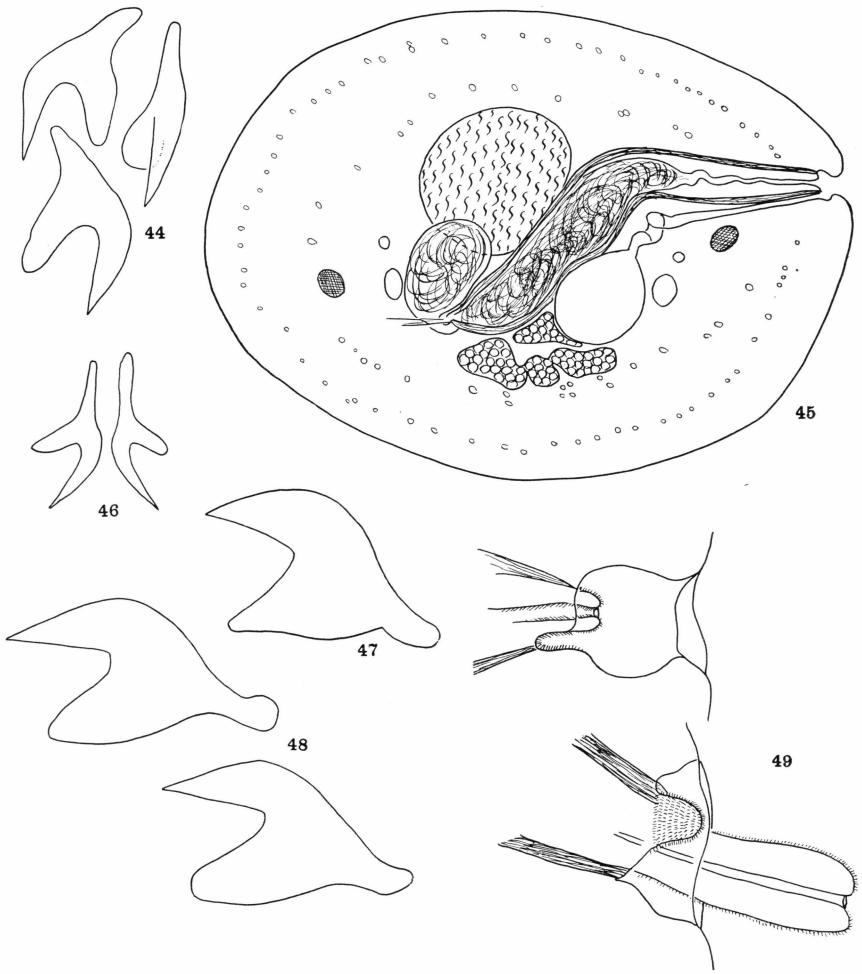

Fig. 44—49. 44—45. *Haploparaksis groenlandica* n. sp.: 44. Rostellar hooks. 45. Transverse section of an adult segment.

46. *Haploparaksis birulai* v. Linstow, rostellar hooks from type specimen.

47—48. *Haploparaksis furcigera* (Rudolphi): 47. Rostellar hooks from KRABBE's type of *T. rhomboidea* from *Anas platyrhynchos* L. (Iceland). 48. Rostellar hooks from a specimen from the same host (Switzerland).

49. *Hymenolepis coronula* (Dujardin), genital atrium with *sacculus accessorius* and cirrus retracted (top) and the same with the latter organs protracted (bottom).

account of the shape of the rostellar hooks. It is however a typical representative of the genus *Haploparaxis* since there is only one testis per segment and not three as in *Hymenolepis*. It is therefore necessary to re-examine the status of the species of *Haploparaxis* described from Anserines. These are: *H. birulai* v. Linstow, 1905, *H. elisae* Skrjabin,

1914, *H. fuliginosa* Solowiow, 1911, *H. furcigera* (Rudolphi, 1819), *H. japonensis* Yamaguti, 1935, *H. murmanica* Baylis, 1919, *H. polystictae* Schiller, 1955, *H. veitchi* Baylis, 1934[1]).

The hooks of *H. fuliginosa* are unknown. According to the shape of the hooks, it is possible to arrange the six remaining species into two groups. The hooks of *H. elisae*, *H. murmanica* and *H. veitchi* have a long handle (dorsal root) and a short blade and those of *H. birulai*, *H. furcigera*, *H. japonensis* and *H. polystictae* have a short handle, the blade and the guard (ventral root) being of about equal length. *H. birulai* posseses a much more slender type of hook and the blade is distinctly longer than the guard. Our drawing of this hook has been made from the type specimen deposited in our collections. v. LINSTOW (1905) gives the length of the hooks as 32 μ and we have found it to be 35—37 μ (fig. 46).

H. japonensis is obviously a synonym of *H. furcigera*. Both these species having hooks of exactly the same shape that are 57—60 μ long in the former species and, 48—58 μ in the latter species. Both the cirrus pouch and the eggs have the same measurements. Consequently, *H. japonensis* becomes a synonym of *H. furcigera*.

Of the three remaining species, *H. groenlandica* comes closest to *H. furcigera* as is clear from the drawings of the hooks and from the following table:

	H. groenlandica	*H. furcigera*	*H. polystictae*
Length mm	11	10—35	12
Width mm	0.78	0,5—1	0,45
Scolex μ	229—297	460—520	350—400
Suckers μ	91—98/84—136	180	98—112
Rostellum diam. μ	136—160	165	126
Hook length μ	41—42	48—58	32
Cirrus pouch μ	160—200/30—23	204—227/27—33	256/22
Eggs μ	37	28—30	—

H. polystictae recently described by SCHILLER (1955) possess hooks that are as long as those of *H. birulai*, but the shape is different. The same species also possesses a very long cirrus pouch that crosses the aporal longitudinal excretory vessels. When compared to *H. furcigera*, *H. groenlandica* has smaller hooks, a shorter cirrus pouch and larger eggs. Consequently, it is retained as a distinct species of the genus *Haploparaxis* harboured by Anseriformes.

[1]) This species is erroneously listed by SCHILLER (1951) as occurring in Charadriiformes.

Hymenolepis coronula (Dujardin, 1845), Railliet, 1899.

This species was collected from a Long-tailed Duck, *Clangula hyemalis* (L.) at Mudderbugten (3.VIII.55). Its anatomy is sufficiently well known since it occurs in a large number of Anserines. We have, however, made a drawing of the *sacculus accessorius* as seen when the cirrus is either retracted or, on the contrary, everted (fig. 49). This shows clearly, that the cirrus and *sacculus* are two distinct structures and that the latter is not an evagination of the cirrus as it is represented by Spassky & Spasskaia (1954, fig. 7 d).

Hymenolepis ductilis Linton, 1927.

Syn. *Taenia microsoma* Krabbe, 1869 *nec* Creplin, 1829.
?*Hymenolepis lateralis* (Mayhew, 1925), Fuhrmann, 1932.
Drepanidotaenia ductilis (Linton, 1927), Lopez-Neyra, 1942.
Microsomacanthus ductilis (Linton, 1927), Lopez-Neyra, 1954.

This species was found abundantly both in a Glaucous Gull, *Larus hyperboreus* Gunn. and in an Iceland Gull, *Larus glaucoides* Mayer at Mudderbugten (3.VIII.55) and at Oqaitsoq (7.VIII.55) respectively.

The worms are 20—25 mm long with a maximum width of 366 μ. The scolex measures 183—215 μ in diameter and is roughly conical. The suckers are relatively large, either round (102 μ diameter) or oval (114—136 μ by 79—109 μ). The rostellum is peculiar in that it telescopes itself into the scolex. Its total length is about 450 μ and its diameter varies from 7—27 μ (fig. 52). There are 10 rostellar hooks, 37—39 μ long and their shape is seen in the accompanying drawing (fig. 50). The longitudinal musculature is well developed, the inner layer forming 8 large bundles of fibres of which four are dorsal and four ventral. The cirrus pouch measures 136—160 μ in length and 14—18 μ in diameter. The cirrus pouch is usually twisted spirally around its longitudinal axis, but when fully relaxed, reaches to the aporal longitudinal excretory vessels. The cirrus is armed with very fine spines. The testes are arranged in a straight line in the posterior half of the segment and the vagina is thick-walled. The eggs measure 41 μ by 29 μ and the embryo is 25 μ in diameter.

We have discovered among Krabbe's original slides the specimen labelled *T. microsoma* from a Glaucous Gull in the Disko Bugt region. The hooks have been redrawn (fig. 51) and are found to be identical with those of *H. ductilis*. Fuhrmann (1913) has shown that under the name *T. microsoma*, Krabbe included at least four distinct species, three from Anserines and one from Gulls. All of these species have similarly shaped hooks yet there size and the anatomy of the strobila are different. The species from Gulls does not appear to have been recognised until

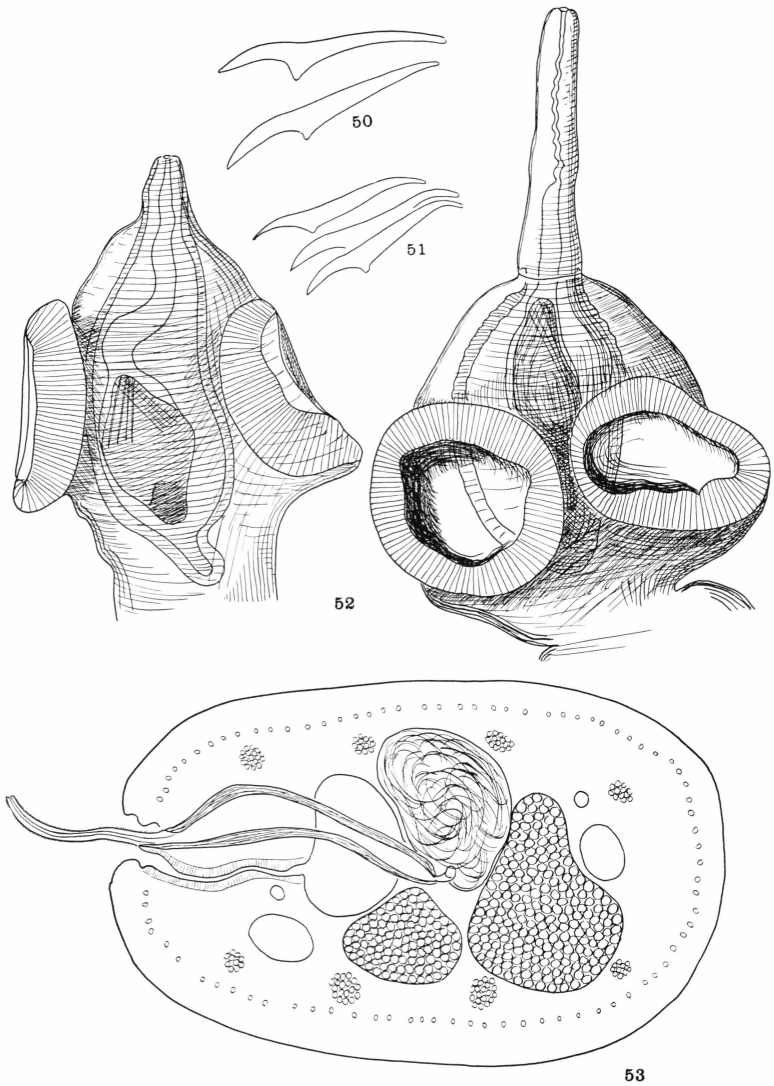

Fig. 50—53. *Hymenolepis ductilis* Linton: 50. Rostellar hooks from present specimens. 51. Rostellar hooks from KRABBE's *T. microsoma*. 52. Scolices with rostellum completely retracted and partly extended. 53. Transverse section through an adult segment passing anterior to the testes.

LINTON (1927) described it under the name *H. ductilis*. As the specific name *microsoma* Creplin, 1829 applies to a different species parasitic in Anserines, it cannot be used for the parasites from Gulls and consequently, the name proposed by LINTON becomes valid.

Twelve species of *Hymenolepis* have been described from Gulls and these can be arranged into two groups according to the shape of the hooks.

In the first group, the blade, guard and handle of the hook are approximately of the same length. It contains the species, *H. cirrosa* (Krabbe, 1869), *H. clavicirrus* Yamaguti, 1940, *H. fusa* (Krabbe, 1869)[1]), *H. fryei* (Mayhew, 1925), *H. neoarctica* Davies, 1938.

From a comparative study based on the original descriptions and drawings, it becomes clear that both *H. fryei* and *H. clavicirrus* are synonyms of *H. fusa* and also, that *H. neoarctica* is a synonym of *H. cirrosa.* Consequently, two species only remain in the first group, *viz. H. fusa* (Krabbe, 1869) and H. *cirrosa* (Krabbe, 1869). Although very closely related by the shape and size of the rostellar hooks, these two species can be easily differentiated by the very large size of the cirrus pouch in *H. cirrosa.*

In the second group of species, all have the "*microsoma*"-type of hook. This group contains the following seven species. *H. baschkiriensis* (Clerc, 1902), *H. ductilis* Linton, 1927, *H. lari* Yamaguti, 1940, *H. lateralis* (Mayhew, 1925), *H. microsoma* (Krabbe, 1869 *nec* Creplin. 1829), *H. multiglandularis* Baczynska, 1914, *H. octacanthoides* Fuhrmann, 1906.

H. multiglandularis and *H. octacanthoides* are the only species belonging to this group that possess a *sacculus accessorius. H. lari* and *H. baschkiriensis* both have very large rostellar hooks that are respectively 108—110 μ and 73 μ long. *H. lateralis* may quite likely be a synonym of *H. ductilis* and, as we have shown above, this name also must be applied to *H. microsoma* of Krabbe.

Consequently, the number of species belonging to the genus *Hymenolepis* that parasitize Gulls is reduced from eleven to seven.

Hymenolepis nitida (Krabbe, 1869), Clerc, 1905[2]).

Syn. *Hymenolepis* (*Echinocotyle*) *nitida* (Krabbe, 1869), Fuhrmann, 1906.
Echinocotyle nitida (Krabbe, 1869), Fuhrmann, 1932.
Hymenolepis lauriei Davies, 1939.
Hymenolepis litoralis Webster, 1947.
Hymenolepis crocethiae Webster, 1947.
Dicranotaenia guschanskoi Krotov, 1952.

Several specimens of this species were obtained from a Sanderling, *Crocethia alba* (Pallas) at Mudderbugten (2.VIII.55). The length of the

[1]) *H. fusa* attributed to the genus *Haploparaxis* by Joyeux & Baer (1928) should be put back into the genus *Hymenolepis* as a re-examination of the original slides has shown. Consequently, it becomes again a synonym of *H. fusa* of Krabbe so that the species *H. neosouthwelli* Hughes, 1938 and *H. baeri* Schiller, 1951 both are also synonymous of *H. fusa* (Krabbe, 1869).

[2]) Rosseter (1907) apparently was the first author to make this combination, but it is quite clear that the species he was dealing with, was *H. nitidulans* and not *H. nitida*!

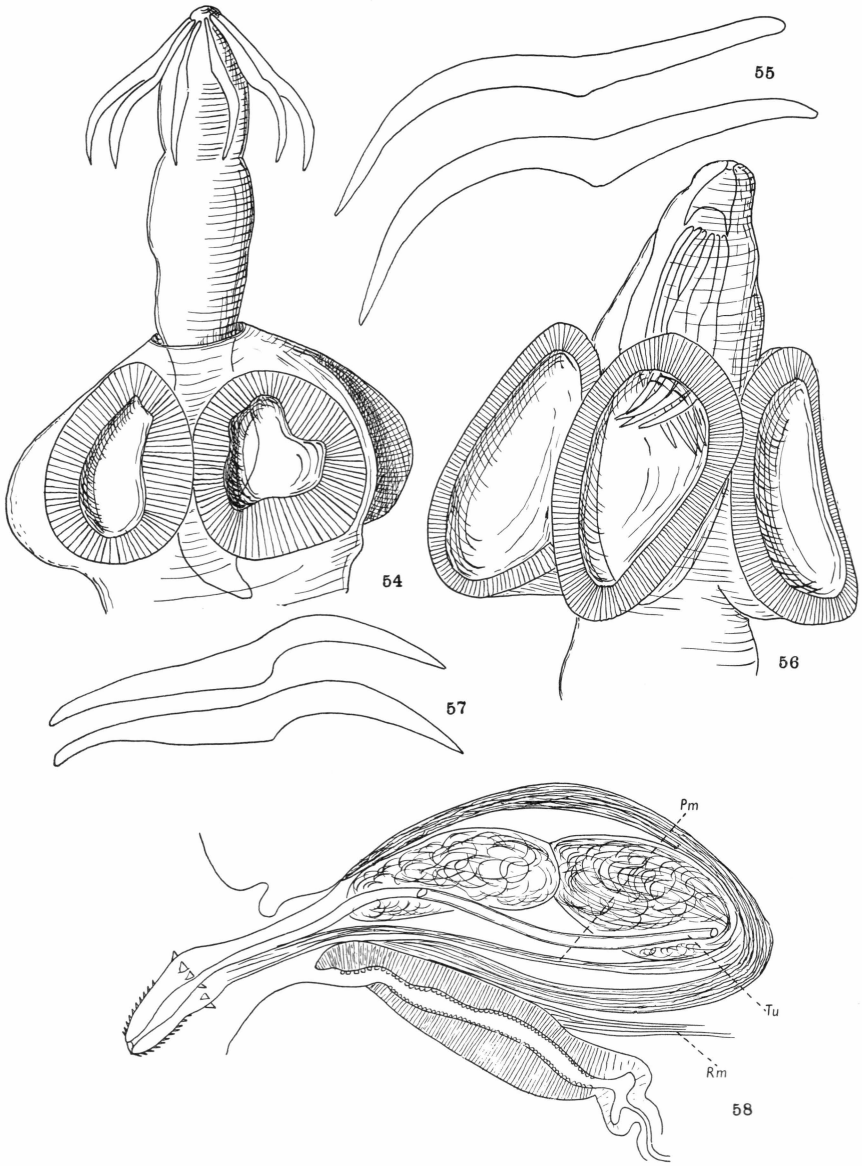

Fig. 54—58. *Hymenolepis nitida* (Krabbe): 54. Scolex with extended rostellum. 55. Rostellar hooks from KRABBE's original slide. 56. Scolex from KRABBE's co-type material. 57. Rostellar hooks from the present specimens. 58. Section through the cirrus pouch and vagina showing the characteristic structure of the latter and the spines on the cirrus; Pm: protractor muscle of the chitinous tube (Tu); Rm: retractor muscle of the distal portion of the vagina.

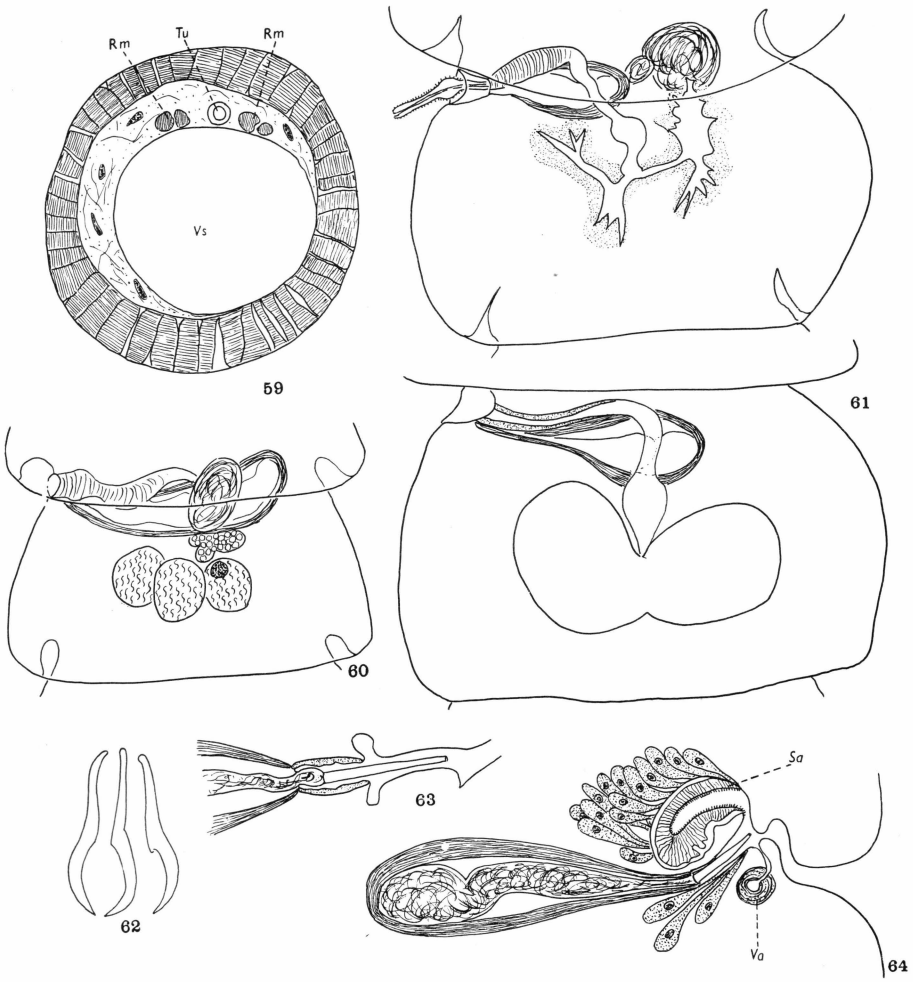

Fig. 59—64. 59—61. *Hymenolepis nitida* (Krabbe): 59. Transverse section of the cirrus pouch showing the thick muscular wall consisting of longitudinal fibres; Rm: retractor muscles of the chitinous tube; Tu: chitinous tube; Vs: *vesicula seminalis*. 60. Young segment with fully developed testes. 61. (top) Gravid segment with empty, H-shaped uterus; (bottom) with uterus containing eggs.

62—64. *Hymenolepis longirostris* (Rudolphi): 62. Rostellar hooks. 63. Chitinous tube terminating the cirrus. 64. Transverse section of the genital atrium showing the very characteristically glandular, *sacculus accessorius*; Sa: *sacculus accessorius* surrounded by unicellular glands; Va: vagina.

worms is about 50 mm and the maximum width, 1 mm. The scolex measures 183—206 μ in diameter at the level of the suckers and the latter, usually oval, measure 125 μ by 79 μ. When the suckers are circular, their diameter is 91 μ. The rostellum is 60 μ in diameter and bears 10

hooks of a rather peculiar and very caracteristic shape (fig. 57). The hook has no guard and since both the blade and the handle are long and narrow and easily deformed, the length of the hook is very variable. Completely isolated and mounted in Berlese-medium, the length of the hooks varies from 84—86 μ. If, however, the hooks are measured, *in situ*, when the rostellum is retracted, the length varies from 73 μ to 94 μ. The suckers are completely devoid of hooklets and these have certainly not fallen out since the worms were still alive when preserved.

The longitudinal musculature consists of two layers of which the inner layer is represented by eight large bundles, four dorsal and four ventral, of about 20—25 fibres each.

The cirrus pouch in perfectly mature segments that have also the female glands fully developed, is 210—220 μ long and 68—69 μ in diameter. The walls of the cirrus pouch are extremely muscular and consist of powerful, longitudinal fibres that describe a loose spiral about the pouch. They appear very clearly on transverse sections of the cirrus pouch (fig. 59). Within the cirrus pouch, there is a large *vesicula seminalis* that communicates with the cirrus proper through a narrow, chitinous, tube, that is never exserted through the cirrus and fades gradually into the lumen of the latter. This chitinous tube is provided with two bundles of longitudinal muscle fibres that flank it on either side (fig. 59). The cirrus itself is conical with small spines, but near the base of the organ are a few, large, triangular spines (fig. 58).

The distal portion of the vagin also has a rather peculiar structure that appears to have never been described before (fig. 58). It possesses a very thick muscular wall consisting almost entirely of circular fibres and to the proximal extremity there is attached a powerful retractor muscle. The lumen of this portion of the vagina is lined with small, chitinous, papillae. At first sight, one might mistake this portion of the vagina for a *sacculus accessorius*. This is not possible, however, as the latter is quite distinct from the vagina as shown below. Moreover, the vagina never opens into a *sacculus accessorius* which should not be confused with a vaginal atrium. The vagina lies on the ventral side of the cirrus pouch and usually passes anteriorly to the latter so that it opens into the genital atrium in front of the cirrus pouch (fig. 60). In young segments, the female genitalia are situated in the aporal half of the segment at about the same level as the most aporal of the three testes. The uterus first appears as a small, sack-like, organ ventral to the ovary. It is sometimes constricted in the middle, where the oviduct opens into it and thus becomes H-shaped (fig. 61). As soon as the eggs fill the uterus its walls flatten out and the whole segment is occupied by the uterus. The eggs are about 45 μ in diameter and the enclosed embryo measures 24—27 μ.

A species with the above anatomy and especially with the peculiar structure of the cirrus pouch and vagina, does not appear to have ever been described before. Quite recently we have received helminths collected from a Sanderling shot about 100 miles from Cape Town, South Africa and found them to be identical with the above species[1]).

KRABBE (1869) described *T. nitida* from a Purple Sandpiper from the Faroes and we have been able to examine his original slides as well as cotype material from the above host. There is no doubt whatever that our specimens agree with KRABBE's material and slides. There remains still a certain difference in hook size. KRABBE stated the length of the hooks as being 110 μ. We find 107—109 μ in the original slides and in co-type material, whereas in the South African material, the hook length is 109—114 μ. Yet in every case, the shape of the hooks is the same. We must therefore conclude that, in this species, the length of the hooks is very variable, and considerably greater than it is usually supposed.

WEBSTER (1947) described under the name *H. litoralis* a species collected from a Sanderling in Texas that has rostellar hooks of the same type as the above, 86—87 μ long. This species is supposed to possess *two sacculi accessorii.* When his drawing (*loc. cit.* fig. 1) is compared with the original slide, there is no trace of such structures. There are, however, a certain number of deeply staining nuceli around the genital atrium that might have been interpreted as *sacculi.* Since the author does not appear to have verified this from sectioned material he has been lead into making this mistake. Although WEBSTER's material is not nearly so well preserved as our own or the South African material, it is possible to make out the characteristic structure of the vagina and also the presence of the chitinous tube within the cirrus pouch. There is no doubt that *H. litoralis* becomes a synonym of *H. nitida.*

On comparing the type specimens of *H. crocethiae* Webster, 1947 and *H. lauriei* Davies, 1939 we have found these two species to be identical. WEBSTER's description is again misleading since he describes a *sacculus accessorius* of which there is no trace whatever in his original slides. The cirrus of *H. lauriei* is distinctly spined in spite of DAVIES' statement to the contrary. The size of the rostellar hooks, as given by WEBSTER, is 86—98 μ. On the type slide, we found 90—93 μ and in *H. lauriei* they measure 88—93 μ. Moreover, in the latter species as described by DAVIES (1939), the vagina lies anterior to the cirrus pouch and this is also the condition found in *H. crocethiae* although it has escaped WEBSTER's notice. There can be no doubt whatever as to the identity of the two species. On the other hand, hook size and internal

[1]) We are very grateful to Miss NELLIE F. PATERSON of the Zoological Department at Cape Town University for having sent us this material.

anatomy correspond to these characters in *H. nitida*. If one compares the total length of the strobila of these species, it is found to vary from 2 mm to 50 mm! That so great a variation exists might, at first site, indicate the existence of *formae minores*. The cause of such an extended variation becomes clear on closer examination. *H. litoralis* is 35 mm long (from WEBSTER's type, since the length is not given in the original description) and there were about 17 worms present in 5 hosts so that each host contained at least 3 worms. On the other hand, *H. crocethiae* is only about 2 mm long, but 180 specimens were collected from six birds so that, in this case, the degree of infestation was about ten times greater than in the former case and the crowding effect is obvious. The possibility of there being two successive infestations in the same host should not be neglected. This is probably the case in our South African material, where, in the same host occur, side by side specimens 20—25 mm long and others, only 4—5 mm long but already containing gravid segments. We have even discovered quite young post larval forms only 535 μ in length in which the genitalia are not yet developed. Yet all of these specimens have the same number, size and shape of rostellar hooks. It is clear that growth of the strobila from the later infestation has been retarded, but that the delay has also been compensated by the precocious sexual maturity of the worms.

In *H. guschanskoi* (Krotov, 1952) the size of the rostellar hooks is stated as being 89—92 μ and, consequently, this species falls within the limits of variation of *H. nitida*.

From the above description of *H. nitida* (Krabbe), it is now clear that the species described by CLERC (1903) as *H.* (*Echinocotyle*) *nitida* is distinct from ours since it possess a *sacculus accessorius*. In order to establish the status of this second species that has the same type of rostellar hook but also a *sacculus accessorius*, it is necessary to review all the species of *Hymenolepis* reported from Charadriiformes. Before doing so, however and in order to facilitate the discussion it will be necessary to redescribe *H. longirostris* (Rudolphi, 1819) of which the type and material from another source are deposited in our collection. This species has also been examined by KRABBE in the Berlin Museum and he subsequently provided the first and only drawing of the hooks together with a short diagnosis (1869). RUDOLPHI's original description states "*Taeniolae multae adfuerunt, duas ad quatuor lineas longae*" (1819), which would mean that the length of the strobila varies from about 4 mm to 9 mm KRABBE gives the length as 60 mm (40—60 mm) and in our own slides made from RUDOLPHI's material the longest worm is 3 mm long. Yet in both cases the size and shape of the hooks is identical.

Hymenolepis longirostris (Rudolphi, 1819), Railliet, 1899.

Syn. *Microsomacanthus longirostris* (Rudolphi, 1819), Lopez-Neyra, 1942[1]).
Nadejdolepis longirostris (Rudolphi, 1819), Spassky & Spasskaia, 1954.

The original material was obtained from a Pratincole, *Glareola pratincola* (L.) at Rimini (Italy) and our own material came from a Ruff, *Philomachus pugnax* (L.) from the Dombes district near Lyons (France). None of our specimens contained gravid segments and all are very contracted. The length varies from 1.2—1.4 mm and the greatest width is 320—411 μ. The scolex measures 113—114 μ in diameter and the oval suckers, 68 μ by 45—57 μ. They bear a double row of spinlets around the sucker-rim and also two median, longitudinal rows. The rostellum is 22 μ in diameter and bears 10 hooks that are 36—37 μ long (fig. 62). The internal anatomy is of the usual type except that the thick-walled cirrus pouch, 170 μ long and 39—41 μ in diameter, contains a short, chitinous, hollow stylet 51 μ long and 2 μ in diameter. The vagina is thick-walled and dorsal to the cirrus pouch, there is a very well developed *sacculus accessorius* into which open many, deeply staining unicellular glands (fig. 64).

Hook size and shape and the presence of a *sacculus accessorius* distinguish this species from all of the others that belong to this group of Charadriiforme tapeworms.

43 species of *Hymenolepis*[2]) have been described so far from Charadriiformes. *H. megalorhyncha* (Krabbe, 1869) has already been transferred into the genus *Dilepis* (see above). The description of *H. magnisaccis* Meggitt, 1927 is totally inadequate and the type, in our collection, useless. *H. porale* Meggitt, 1927, described from a fragment, is unrecognizable. We therefore propose to consider these two species as *nomina nuda*. *H. glandularis* Fuhrmann, 1909 is the only species described from Charadriiformes in which the rostellum is replaced by a glandular mass.

Eleven species only possess the characteristic hook shape in which the guard of the hook (ventral root) is lacking. Curiously enough, nearly all of these species have been placed at one time or another into the genus (subgenus) *Echinocotyle*. They are the following: *H. charadrii* Yamaguti, 1935, *H. crocethiae* Webster, 1947, *H. glareolae* (Singh, 1952),

[1]) The genus *Microsomacanthus* Lopez-Neyra, 1942 was designated but not defined by Lopez-Neyra (1942). It has been accepted by Spassky & Spasskaia (1954). While retaining Rudolphi's species in this genus (p. 86), the latter authors also place it in the genus *Nadejdolepis* (p. 90)! This shows how fragile and useless such "generic" concepts are and only contribute to overload and to complicate the zoological nomenclature.

[2]) Also included are the species ascribed to the genus *Echinocotyle* Blanchard, 1891 since they do not possess in common any character of generic value.

H. guschanskoi (Krotov, 1952), *H. lauriei* Davies, 1939, *H. litoralis* Webster, 1947, *H. longirostris* (Rudolphi, 1819), *H. nitida* (Clerc, 1903 *nec* Krabbe, 1869), *H. nitida* (Krabbe, 1869), *H. nitidulans* (Krabbe, 1882), *H. vallei* (Stossich, 1892)[1]).

Of the above species, we consider *H. vallei* as a *nomen nudum* since its description is totally inadequate and could apply equally well to all the other species with this shape of hook. Moreover, no type or cotypes are available. *H. laurei*, *H. crocethiae*, *H. litoralis* and *H. guschanskoi* have been reduced to synonymy with *H. nitida*.

H. nitidulans (Krabbe, 1882)[2]) was incompletely redescribed by CLERC (1903) and also by SOUTHWELL (1924). It has been chosen as the type of the genus *Nadejdolepis* Spassky & Spasskaia, 1954 on a morphological basis that is quite inacceptable, since this genus contains quite unrelated species from Charadriiformes.

Two more species having *sacculi accessorii* have also been described *viz. H. nitida* (Clerc, 1902 *nec* Krabbe, 1869) and *H. glareolae* (Singh, 1952). CLERC (1902) indicates the length of the rostellar hooks as 70 μ, subsequently (1903), they are stated as being 80 μ long and, in the same paper, from the scale of the drawing, the hooks should be 58 μ long! Singh (1952) gives the length of the hooks in *H. glareolae* as 65—72 μ but according to the scale beside his drawing of the hook, the latter should be at least 80 μ long. As mentioned above, such great variations in hook length can occur if the hooks are measured when still attached to the rostellum. We consider, therefore, that these three species posessing *saculi accessorii* are identical and since the specific name *nitidulans* has priority, both *nitida* Clerc *nec* Krabbe and *glareolae* are synonyms of the latter.

H. charadrii is also a small species (3,9 mm) and has rostellar hooks, 57—66 μ in length; there is, however, no *sacculus accessorius* and its seems rather unlikely that the latter might have been overlooked. YAMAGUTI (1935) considers his diagnosis as provisional until more material has been examined. The species should be retained for the time being as a *species inquirendum*.

It has thus been possible to reduce from eleven to four, the number of species with this shape of hook that occur in Charadriiformes. We have arranged a key for their determination and also give a short diagnosis of each together with a list of the hosts from which it is certain that the species has been reported.

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[1]) *H. hypoleuci* (Singh, 1952) is obviously a synonym of *H. uralensis* Clerc, 1902.

[2]) The worms described as *H. nitidulans* (Krabbe, 1882) by ROSSETER (1907) from *Turdus merula* L. bear no relationship to this species.

1 { *Sacculus accessorius* present 2
  { *Sacculus accessorius* absent 3

2 { Rostellar hooks 36—37 μ long ..... *H. longirostris*
  { Rostellar hooks 54—80 μ long ..... *H. nitidulans*

3 { Rostellar hooks 87—114 μ long ..... *H. nitida*
  { Rostellar hooks 57—66 μ long ..... *H. charadrii*

Hymenolepis longirostris (Rudolphi, 1819), Railliet, 1899.

Length: 3—60 mm. Width: 320—410 μ. Scolex: 113—114 μ diameter. Suckers sometimes spined, 68 μ / 45—57 μ. Rostellar hooks: 36—37 μ. Cirrus pouch: 170 μ / 39—40 μ *Sacculus accessorius* clearly glandular.

Hosts: *Glareola pratincola* (L.), *Philomachus pugnax* (L.).

Hymenolepis nitidulans (Krabbe, 1882), Fuhrmann, 1906.

Syn. *H.* (*Echinocotyle*) *nitida* Clerc, 1902 *nec.* Krabbe, 1869.
Hymenolepis glareolae (Singh, 1952).
Nadejdolepis nitidulans (Krabbe, 1869), Spassky & Spasskaia, 1954.

Length: 2—10 mm. Width: 150—300 μ. Scolex: 130—200 μ diameter. Suckers spined, 108 μ/60 μ. Rostellar hooks: 54—80 μ. Cirrus pouch: 140—166 μ/20—30 μ. *Sacculus accessorius* clearly glandular.

Hosts: *Erolia maritima* (Brünnich), *E. alpina* (L.), *Tringa glareola* L., *Charadrius hiaticula* L.

Hymenolepis nitida (Krabbe, 1869), Fuhrmann, 1906.

Syn. *H.* (*Echinocotyle*) *nitida* (Krabbe, 1869), Clerc, 1903.
Echinocotyle nitida (Krabbe, 1869), Fuhrmann, 1932.
Hymenolepis lauriei Davies, 1939.
Hymenolepis litoralis Webster, 1947.
Hymenolepis crocethiae Webster, 1947.
Dicranotaenia guschanskoi Krotov, 1952.

Length: 3—50 mm. Width: 180—350 μ. Scolex: 183—270 μ diameter. Suckers not spined, 102—136 μ/79—125 μ. Rostellar hooks 87—114 μ. Cirrus pouch: 159—250 μ/68—75 μ, cirrus spined. No *sacculus accessorius.*

Hosts: *Erolia maritima* (Brünnich), *E. minuta* (Leisl.), *Crocethia alba* (Pall.), *Limosa limosa* (L.). *Arenaria interpres* (L.), *Haematopus ostralegus* L.

Hymenolepis charadrii Yamaguti, 1935 *sp. inqr.*

Length: 3.9 mm. Width: 400 μ. Scolex: 130 μ diameter. Suckers not spined, 80 μ diameter. Rostellar hooks: 57—66 μ. Cirrus pouch: 90 μ/30—36 μ (?).

Host: *Charadrius alexandrinus dealbatus* (Swinhoe).

It is clear that these four species from Charadriiformes are very closely related to one another and that they also possess the same number and shape of rostellar hooks. Different types of *sacculi accessorii* have been described in various species of the genus *Hymenolepis* that are in no way related to each other and also occur in different host groups. It is difficult to understand the significance of such a structure unless it be interpreted as a rudimentary or incompletely developed cirrus pouch, in which case its position in the segment could be explained but its function would remain obscure. There does not appear to exist any relationship between spined suckers and a *sacculus accessorius* since both occur separately in several species. It would therefore seem that within the genus *Hymenolepis* the shape of the rostellar hooks is the most important specific character, but also, that a much greater variation in size of these hooks exists than is usually taken into consideration.

In the four species from Charadriiformes the shape of the hooks has remained the same but the internal anatomy has evolved in two different directions. It is probable that similar trends will be found in species of this genus from other host groups, since they represent a form of evolution that is a result of the isolating mechanism within distinct host groups.

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Færdig fra trykkeriet den 10. juli 1956.