"The Taxonomy and Distribution of the Helminth Parasites of Some Welsh Birds, with Observations on their Dissemination."

A Thesis submitted to the University of London for the Degree of Doctor of Philosophy

by

Brian James ELCE

Department of Parasitology
London School of Hygiene and Tropical Medicine.

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ABSTRACT

1). Between August, 1960 and December, 1963, more than five hundred and seventy-six birds representing twelve orders, thirty families and seventy-nine species were examined for helminth parasites in the County of Pembrokeshire. The overall infection was 61.4% and only twelve species were uninfected.

2). The material recovered consisted of eighteen species of trematodes, forty-three species of cestodes and seventeen species of nematodes. Two new species are described, Choanotaenia larimarina Elce, 1962 and Gymnophallus numanii sp. nov.

3). There are thirty-seven new host records for Western Europe. Three species are new to Europe and five species are new to Britain. Forty-four new host records for Britain are recorded and thirty-two species are recorded for the first time in Wales.

4). The incidence of helminths is related to the host's diet and the ecological background.

5). A survey was made of the helminths in domestic birds in Pembrokeshire, both by faecal examination and by post-mortem. The most common parasites were the nematodes Heterakis gallinarum (Schrank, 1788) - 73.9%, Capillaria obsignata Madsen, 1945- 45.05%, and Ascaridia galli (Schrank, 1788) - 35.1%.

The results are compared with recent surveys by other workers and differences are due to this work being based on field tests and not the more usual laboratory post-mortems.

6). Infective eggs of the above species were fed to selected wild birds, principally rooks (Corvus frugilegus L.) and jackdaws (Corvus monedula L.), which were maintained on a normal and on a Vitamin A deficient diet. Wild birds do not act as hosts to poultry helminths and their significance as disseminators is limited to infected droppings. Dissemination of eggs on feathers and claws is difficult to estimate.

7). The life cycle of Capillaria resecta (Dujardin, 1843) was attempted to assess Madsen's suggested synonymy with C. anatis (Schrank, 1790). Circumstantial evidence indicates that the species are not synonymous.

LIST OF CONTENTS

Title Page (i)

Abstract (ii)

List of Contents (iii)

General Introduction. 1

Table A1. A list of the Helminths recovered with their Hosts 6

Materials and Methods. 24

Table A2. A list of the Bird Hosts with Helminths recovered. 28

Part I. Taxonomy. Section A. Class Trematoda 48

Order Digenea 49

Family : Plagirochidae Ward, 1917

(1) Plagirochis maculosus (Rudolphi, 1802) 52

Plate 1 P. maculosus Legend. 54

Table A3. P. maculosus 62

Family : Dicrocoeliidae Odhner, 1910 64

(2) Lyperosomum longicauda (Rudolphi, 1809) 64

Plate 1 L. longicauda Legend 67

Table A4. L. longicauda 70

(3) Lutztrema monenteron (Price & McIntosh, 1935) 71

Plate 3 L. monenteron. Legend 73

Plate A5 L. monenteron 78

(4) Zoonorchis petiolatum (Railliet, 1900) 79

Plate 4 Z. petiolatum. Legend 82

Plate A6. Z. petiolatum 86

Family : Microphallidae Travassos, 1920 87

(5) Gymnophallus deliciosus (Olsson, 1893) 88

Plate 5 G. deliciosus Legend 89

Table A7. G. deliciosus 93

(6) Gymnophallus numenii sp. nov. 94

Table A8. G. numenii 97

Family : Echinostomatidae Looss, 1902 99

(7) Echinostoma revolutum (Fröhlich, 1802) 100

Plate 6 E. revolutum. Legend 101

Table A9. E. revolutum 105

(8) Himasthla rhigedana Dietz, 1909 107

Plate 7 E. revolutum & H. rhigedana. Legend 108

Plate 8 H. rhigedana Legend 113

Table A10. H. rhigedana. 117

Plate 9 Himasthla spp. Legend 122

(9) Himasthla leptosoma (Creplin, 1829) 124

Plate 10 Himasthla spp. Legend 126

Plate 11 Himasthla spp. Legend 130

Table A11 H. leptosoma 133

(10) Himasthla elongata (Mehlis, 1831) 139

Table A12 H. elongata 143

Plate 12 Himasthla spp. Legend 145

Table A13 Himasthla spp. Compared 149

Table A14 Himasthla spp. with 29 head-spines 151

Family : Philophthalmidae Travassos, 1918 152

(11) Parorchis pittacium (Braun, 1901)

Plate 13 P. pittacium Legend 155

Plate 14 P. pittacium Legend 156

Plate 15 P. pittacium & E. virgula Legend 163

Table A15 P. pittacium 167

(12) Echinostephilla virgula Lebour, 1909 170

Plate 16 E. virgula Legend 172

Table A16 E. virgula 177

Family : Pronocephalidae Looss, 1902 182

(13) Parapronocephalum symmetricum Belopolskaya, 1952 182

Plate 17 P. symmetricum Legend 183

Family : Cycloceliidae Kossack, 1911 187

(14) Cyclocoelum (C.) mutabile (Zeder, 1800) 189

Plate 18. C.(C.) mutabile Legend 191

(15) Cyclocoelum (Hyptiasmus) elongatum Harrah, 1921 195

Plate 19 C. (Hyptiasmus) elongatum Legend 197

Table A17 C. (H.) elongatum 201

Family : Brachylaemidae Joyeux & Foley, 1930 203

(16) Brachylaemus fuscatus (Rudolphi, 1819) 204

Plate 20 B. fuscatus Legend 206

Table A18 B. fuscatus 210

Family : Leucochloridiidae Dollfus, 1934 211

Table A19 Comparison of classifications 214

(17) Leucochloridium certhiae McIntosh, 1927 220

Plate 21 L. certhiae Legend 221

(18) Leucochloridium melospizae McIntosh, 1932 226

Plate 22 L. melospizae Legend 228

Section B. Class Cestoda 233

Order pseudophyllidea Carus, 1863

Family : Diphyllobothiidae Lühe, 1910

(1) Ligula intestinalis (Linnaeus, 1758) 234

Order Tetrabothridea Baer, 1954 238

Family : Tetrabothriidae Braun, 1900

(2) Tetrabothrius cylindraceus (Rudolphi, 1819) 239

Plate 23 Tetrabothrius spp. Legend 242

(3) Tetrabothrius erostris (Lönnberg, 1889) 245

(4) Tetrabothrius immerinus (Abildgaard, 1790) 247

Plate 24 T. immerinus Legend 248

Order Cyclophyllidea Ben. in Braun, 1900 251

Family : Davaineidae Fuhrmann, 1907

(5) Raillietina (Skrjabinia) bonini (Megnin, 1899) 252

Plate 25 R. (S.) bonini. Legend 254

(6) Ophryocotyle insignis Lönnberg, 1890 257

Plate 26 Ophryocotyle spp. Legend 261

(7) Ophryocotyle proteus Friis, 1870 263

Family : Dilepidae Railliet & Henry, 1909 265

(8) Dilepis undula (Schrank, 1788) 265

Table A20 D. undula 271

(9) Anomotaenia constricta (Molin, 1858) 273

Plate 27 A.constricta Legend 276

(10) Anomotaenia micracantha (Krabbe, 1869) 281

Plate 28 A. micracantha. & P. embryo. Legend 283

Table A21 A. micracantha 287

(11) Paricterotaenia embryo (Krabbe, 1869) 289

(12) Paricterotaenia mariae Mettrick, 1958 292

Table A22 P. mariae 293

(13) Paricterotaenia stellifera (Krabbe, 1869) 295

Plate 29 P. stellifera & T. megalocephala 299

(14) Trichocephaloides megalocephala (Krabbe, 1869) 300

Table A23 T. megalocephala 304

(15) Gryporhynchus retirostris (Krabbe, 1869) 306

Plate 30 G. retirostris Legend 308

(16) Cheanotaenia clavigera (Krabbe, 1869) 313

Plate 31 Ch. clavigera & Ch. unicoronata 315

Table A24 Ch. clavigera 320

(17)	Choanotaenia larimarina Elce, 1962 (bound between pages 321 - 322)	
(18)	Choanotaenia unicoronata (Fuhrmann, 1908)	322
	Table A25 Ch. unicoronata	324
A Discussion on the Family Dilepidae		326
Family :	Hymenolepididae Railliet & Henry, 1909	335
(19)	Hymenolepis (H.) anatina (Krabbe, 1869)	338
	Plate 32 H. (H.) anatina & H.(H.) cirrosa	342
(20)	Hymenolepis (H.) cirrosa (Krabbe, 1869)	344
	Table A26 H. (H.) cirrosa	348
(21)	Hymenolepis (H.) compressa (Linton, 1892)	350
	Plate 33 H. (H.) compressa & H.(H.) farciminosa	352
	Table A27 H. (H.) compressa	356
(22)	Hymenolepis (H.) ductilis (Linton, 1927)	357
	Plate 34 H. (H.) ductilis Legend	359
(23)	Hymenolepis (H.) farciminosa (Goeze, 1782)	363
(24)	Hymenolepis (H.) naja (Dujardin, 1845)	366
(25)	Hymenolepis (H.) parina (Fuhrmann, 1907 a)	366
	Plate 35 H. (H.) parina Legend	368
	Table A28 H. (H.) parina	372
(26)	Hymenolepis (H.) passeris (Gmelin, 1790)	374
	Plate 36 H. (H.) passeris & H. (H.) rectacantha	376
	Table A29 H. (H.) passeris	379
(27)	Hymenolepis (H.) rectacantha (Fuhrmann, 1906 b)	381
	Table 30 H. (H.) rectacantha	384
(28)	Hymenolepis (H.) serpentulus (Schrank, 1788)	386
	Plate 37 H. (H.) serpentulus & H. (H.) solowiow. Legend	388
(29)	Hymenolepis (H.) solowiow (Skrjabin, 1914)	392

(30) Hymenolepis (H.) stylosa (Rudolphi, 1810) 395

Plate 38 H. (H.) stylosa & D. acuminata 397

(31) Diorchis acuminata (Clerc, 1902) 401

Table A31 D. acuminata 404

(32) Aploparaksis brachyphallos (Krabbe, 1869) 406

Plate 39 Aploparaksis spp. 408

(33) Aploparaksis crassirostris (Krabbe, 1869) 412

(34) Aploparaksis dujardini (Krabbe, 1869) 416

(35) Aploparaksis filum (Goeze, 1782) 420

Plate 40 Aploparaksis spp. 423

(36) Aploparaksis furcigera (Nitsch in Rud., 1819) 425

Table A32 A. furcigera 427

(37) Aploparaksis hirsuta (Krabbe, 1882) 429

(38) Fimbriariodes intermedia (Fuhrmann, 1913) 430

Plate 41 F. intermedia & Unidentified spp. 431

Unidentified species

(39) Hymenolepis sp. 436

(40) Hymenolepis sp. 436

(41) Dicranotaenia sp. 437

(42) Dilepis sp. 437

(43) Dilepis sp. 437

VOLUME II

Part I. Taxonomy. Section C. Class Nematoda 439

Introduction to the Class 440

Family : Trichuridae Railliet, 1915 444

(1) Capillaria caudinflata (Molin, 1858) 448

Plate 42. C. caudinflata & C. contorta. 449

Table A33 C. caudinflata. 453

(2)	Capillaria contorta (Creplin, 1839)	454
(3)	Capillaria obsignata (Madsen, 1945)	457
	Plate 43 C. obsignata & C. ovopunctata	459
	Table A34 C. obsignata	463
(4)	Capillaria ovopunctata (von Linstow, 1873)	464
(5)	Capillaria resecta (Dujardin, 1843)	466
	Plate 44 C. resecta & C. vanelli. Legend	467
(6)	Capillaria vanelli (Rudolphi, 1819)	470
	Table A35 C. vanelli	472
(7)	Capillaria spp.	474
	Plate 45 Capillaria spp.	475
(8)	Capillaria sp.	477
Family :	Syngamidae	478
(9)	Syngamus trachea (Montagu, 1811)	478
Family :	Heterocheilidae Railliet & Henry, 1912	
(10)	Contracaecum spiculigerum (Rudolphi, 1809)	479
	Plate 46 C. spiculigerum & P. crassum	483
(11)	Porracaecum crassum (Deslongchamps, 1824)	485
(12)	Porracaecum ensicaudatum (Zeder, 1800)	487
	Plate 47 P. ensicaudatum & P. semiteres	489
	Table A36 P. ensicaudatum	493
(13)	Porrocaecum semiteres (Zeder, 1800)	496
(14)	Porrocaecum spirale (Rudolphi, 1795)	499
	Plate 48 P. spirale & S. tridentata	500
	Table A37 P. spirale	504
Family :	Physaloptera idae Leiper, 1908	
(15)	Streptocara tridentata (von Linstow, 1877)	505
Family :	Acuariidae Seurat, 1913 a	
(16)	Seuratia puffini Yamaguti, 1941	506
	Plate 49 S. puffini. Legend	507

Family : Acanthocephalidae Meillet, 1916 (xi)
(17) Viguieva euryopteva (Rudolphi, 1819) 511
Plate 50 V. euryopteva. Legend 512
Table A38 V. euryopteva 516
Key to known species of Viguieva 517

Part II. Some comments on the new records, incidence of helminth species and ecological background of the hosts. 518
Introduction. 519
Section A. The New Records 519
(I). New Host records for Western Europe 519
Table B 1. Thirty-seven host records for Western Europe. 520/I
(2) Three species recorded for the first time in Europe 526
Table B 2. (a) Three species recorded for the first time in Europe. 527
(b) Five species recorded for the first time in Britain.
(3) Five species recorded for the first time in Britain. 528
(4) New Host records for Britain. 529
Table B 3. Forty-four new Host records for Britain 530/I
Section B. The Incidence of Helminth species recovered. 532
(I) The Incidence of Helminth Classes related to Host Orders and Families. 532
Table B 4. The Incidence of Helminth species related to the host. 534
Table B 5. The Incidence of Helminth species related to host's diet and habitat. 537/8
(2) Host species from which no helminths were recovered. 539
Table B 6. A list of Bird species from which no helminths were recovered. 540
Section C. Some ecological considerations. 542
Introduction.
(I) The parasite and the micro-environment 544
a). The diet of the host. 544
(i) General Influences 544
(ii) The effect of changes of diet upon the parasite. 545

b). The age of the host 547
c). Seasonal Changes 548
d). The Intensity of infection and the presence of other parasites. 549
e). Changes of location within the host. 550
(2) The parasite and the macro-environment. 551
a). The Host's mode of life 551
b). The migration of the host. 552
c). The abundance of the host. 553
d). Geographical factors 554
Conclusions 555
Part III "A Survey of the Helminth Parasites in Domestic Poultry in Pembrokeshire". 556
Introduction. 557
Section A. The results of a survey on the helminth parasites of the domestic fowl (Gallus gallus dom. L.) in Pembrokeshire. 562
Table C I. Records of the Intestinal Helminths in Adult Domestic Fowl from the United Kingdom. 563
Discussion 564
a). The general incidence of intestinal nematodes. 564
Table C 2. The Incidence and Seasonal Variation in the Intestinal Nematodes of the Adult Domestic Fowl. 565
Table C 3. The % Incidence of Intestinal Nematodes of the Adult Domestic Fowl related to different categories of management. 569
b). The age of the host. 570
c). The environement of the host. 573
d). The seasonal incidence of the Intestinal Nematodes in the Adult Domestic Fowl 576
Table C 4. A summary of the weather conditions in Central Pembrokeshire from July, 1960 to December, 1963. 578

Table C 5. The % Incidence of Intestinal Nematodes of the Domestic Fowl at various ages.

Table C 6. The % Seasonal Incidence of Intestinal Nematodes (July, 1960 - December, 1961) compared with the results of previous workers.

Table C 7. The % Seasonal Incidence of Heterakis gallinarum (January, 1962 - December, 1963) related to different categories of management. 584

Table C 8. The % Seasonal Incidence of Ascaridia galli (January, 1962 - December, 1963) related to different categories of management. 586

Table C 9. The % Seasonal Incidence of Capillaria obsignata (January, 1962 - December, 1963) related to different categories of management. 588

e). The pathogenicity of Intestinal Nematodes. 589

f). The conditions for the establishment of chronic infections. 590

g). The effect of Multiple Infections 591

Table C 10. The effect of multiple infections on the numbers of each species present expressed in eggs per gram of faeces 593

Section B. The results of a survey on the helminth parasites of a domestic turkey (Meleagris gallopavo dom.L.) in Pembrokeshire. 594

Table C 11. The helminth parasites of the domestic turkey (July, 1960 - December, 1963). 595

Discussion.

a). The general incidence of intestinal nematodes 597

Table C 12. The % Infestation of the turkey with Intestinal Nematodes related to seasonal variation. (July, 1960 - December, 1963). 598

b). The age of the host. 599

c). The seasonal variation of intestinal nematodes 600

d). The environment of the host 600

Table C 13. The % Infestation of the turkey with Intestinal nematodes related to different categories of management. (January, 1962 - December, 1963). 601

e). The pathogenicity of intestinal nematodes. 603

Summary. 603

Part IV. Some experimental work on the dissemination of the nematodes of poultry. (With an account of an attempt to determine the life-cycle of Capillaria resecta (Dujardin, 1843), parasitic in the Rook (Corvus frugilegus L.) 605

Introduction. 606

Materials and Methods 607

Results 611

A). Natural Infections

(i) Examination of wild birds by post-mortem. 611

(ii) Examination of dirt from external parts 611

(iii) The introduction of nematodes to 'clean' pasture 612

Table D I. The increase in the nematode infection of poultry placed on 'clean' pasture through contact with wild birds 614

B). Artificial Infections. 615

(i) Rooks maintained on a normal diet.

Table D 2. The experimental infection of rooks maintained on a normal diet. 616

(ii) Pigeons maintained on a normal diet 617

(iii) Starlings maintained on a normal diet 619

(iv) Rooks and Jackdaws maintained on a Vitamin A deficient diet. 620

Table D 3. The experimental infection of birds maintained on a Vitamin A deficient diet. 621

Summary 622

Appendix. The life-cycle of Capillaria resecta (Dujardin, 1843), parasitic in the small intestine of the Rook. (Corvus frugilegus L.) 623

Acknowledgements

References 628-657

Map A map showing the farms visited and principal areas from which birds were examined is contained in an envelope at the end of Volume II.

GENERAL INTRODUCTION

It is only in recent years that the wild birds of Britain have been studied as an ecological unit for helminth material. Prior to this, workers who have contributed both description and records include Bellingham (1844), Thomson (1844), Baird (1853), Lebour (1905, 1909, 1911), Nicoll (1906, 1907 a and b, 1909, 1923), Lewis (1925, 1926 a and b), McIntosh and Nicoll (1927), Baylis (1928, 1939), Clapham (1938, 1940b), Rees (1933, 1937, 1939, 1940), Jennings (1954, 1955, 1959), Ash (1957), and Sandeman (1959 a and b). The majority of British surveys have been concerned with domestic stock and game and in this work Lewis (1930), Morgan (1932), Foggie (1933), Clapham (1936, 1937, 1940a), Morgan and Wilson (1938, 1939), Taylor (1938), Owen (1951), Soliman (1955), Clarke (1962), Wakelin (1964) and Norton (1964) are foremost.

The first major work devoted exclusively to bird helminths, T.I. Davies' Ph.D. thesis on coastal birds for the University of Wales (1937), remains for the most part unpublished and it is only since 1950 that there have been adequate surveys. Mettrick's thesis on land birds - mainly passerine - in Hertfordshire (1958a and b, 1959,

1960a and b), I.C. William's thesis on sea and wading birds in West Wales (Ph.D. awarded 1956, results published 1961), Beverley-Burton's studies on helminths in ducks (Anatidae) in Suffolk and St. James Park, London (1958a and b, 1959, 1964), Pemberton's surveys on passerines in Hertfordshire (1960) and Laridae in Lancashire (1963) and the work of Burt (1962) which is still in progress, are of prime importance. Other surveys, e.g. Keymer _et al._, (1962) are of veterinary rather than helminthological interest.

The select list of theses above can be seen to be limited in that no one worker has selected a locality and made a comprehensive ecological survey of all available species of hosts and their possible inter-action at all times of the year. The only work on this scale is that of Denton and Byrd (1948, 1951) but the value is undermined both by the extent in time of the survey, sixteen years, and by the geographic and climatological area covered - the whole of North America represents too vast a range to form an ecological unit. The survey discussed herein is an attempt to make good this deficiency and to provide the first comprehensive assessment of helminth fauna of birds in Britain. The results

of this co-ordination of published and unpublished materials makes for excessive length but can be justified by several considerations amongst which the ignorance of unpublished work from Wales in the mid-thirties (Davies, 1937, Walker, 1937, Evans, 1938) and the lack of data relating specifically to British Material at the Natural History Museum are significant. To combat this latter need, the historical introduction to each species includes all 'first records' from Britain which the writer has been able to trace. Inevitably, some records will be missing but those listed below are not available in as comprehensive a format elsewhere. The writer will eventually make his lists available to the Museum.

The extreme length and time-consumption involved in describing each species was seriously debated by the writer since the cestodes in particular, have benefitted from recent redescriptions. However, the number of new host records included and the possibilities of concommitant variations in form even in well known species, makes it desirable to include details. This view was strengthened by an all-important and unprecedented factor which has arisen during the time taken on this survey. Due to the

severe winter of 1962/1963 and to the increasing use of poisonous insecticides, the wild bird population in Britain has shown an overall decrease of between 30-50%. (The exact percentage varies according to different authorities). After the January and February experienced in 1962, the Wren (Troglodytes troglodytes (L.)), showed a 95% mortality from which it has not even begun to recover. Similar figures hold for many passerines and even the commonest British Bird, the Chaffinch (Fringilla coelebs L.), was in March, 1962 added to the list of protected birds to enable it to recover the losses suffered during the preceding months. The Owls, Hawks and other birds of prey are greatly depleted due to accumulative poisoning from their food sources and are becoming increasingly infertile. Even the best known species of helminth are redescribed below, therefore, in the consciousness that they may not be available for study again for several years; in fact, until either biological control of insects is fully established or the wild bird population has become immune. The side effects of these factors are certain to involve some modification of helminth populations if not their morphology, and this also justifies the

attempted comprehensiveness of this work.

Although primarily to be included in the ecological account, (Part II), it may be mentioned that the choice of locality and period of time were most fortunate. Pembrokeshire, as a peninsula in the warm south-west, is an ideal habitat for an indigenous population and for attracting passage migrants. The climate is exceptionally mild for Britain and yet, during the three and a half years of study, there was an abnormally severe winter and an unusually warm summer. Thus, several of the more rare migratory birds were attracted or forced into the area.

Part I deals at length with the species recovered, in their respective sections. Part II is ecological, considering the micro-habitat - the host, and the macro-habitat - the locality, and climatic conditions. Part III records the results of the survey on domestic helminths and Part IV the experimental studies deriving from Part III.

The helminths recovered are listed in Table 1, together with the hosts in which they were present, while the bird hosts and numbers of helminths are included in Table II.

TABLE I A list of the Helminthes recovered with their Hosts

Phylum - PLATYHELMINTHES

CLASS - TREMATODA

Order - DIGENEA

Sub-Order - Prostomata.

Family PLAGIORCHIIDAE. Ward, 1917.

S.F. Plagiorchiinae Pratt, 1902.

Genus: Plagiorchis Luhe, 1899.

1) Plagiorchis maculosus (Rud., 1802) Braun, 1901.

: Apus apus L.

Hirundo rustica L. (1st British record)

Family DICROCOELIIDAE Odhner, 1910

S.F. Dicrocoeliinae Looss, 1899.

Tribe Lyperosomini Yamaguti, 1958.

Genus: Lyperosomum Looss, 1899.

2) Lyperosomum longicauda (Rud., 1809) Braun, 1902.

Corvus frugilegus L.

Corvus corone corone L. (1st British record)

Pica pica (L.) (1st British record)

Garrulus glandarius (L.)

Turdus philomelos clarkii Hartert.

Turdus merula L.

Turdus pilaris L. (New Host record)

Tribe Lutztrematini Yamaguti, 1958.

Genus: Lutztrema Travassos, 1941.

3) Lutztrema monenteron (Price and McIntosh, 1935) Travassos, 1941.

Turdus merula L.	
Turdus musicus L.	(New Host record)
Erithacus rubecula melophilos Hartert	(1st British record)
Parus major L.	(New Host record)
Passer domesticus L.	(New Host record)

Tribe Eurytrematini Yamaguti, 1958.

Genus: Zoonorchis Travassos, 1944

4) Zoonorchis petiolatum (Railliet, 1900) Denton & Byrd, 1951.

Corvus corax L.	(New Host record)
Corvus corone corone L.	(New Host record)
Pica pica (L.)	(1st British record)
Turdus musicus L.	

Family MICROPHALLIDAE Travassos, 1920.

S.F. Gymnophallinae Odhner, 1905.

Genus: Gymnophallus Odhner, 1900.

5) Gymnophallus deliciosus (Olsson, 1893) Odhner, 1900.

Larus marinus L.	(1st British record)
Larus fuscus L.	
Larus argentatus Pont.	
Larus canus L.	(1st British record)
Larus ridibundus L.	(New Host record)

6) Gymnophallus numenii sp. nov.

Numenius arquatus (L.)

Family ECHINOSTOMATIDAE Looss, 1902, emend. Poche, 1926.

S.F. Echinostomatinae Faust, 1929.

Genus: Echinostoma Rudolphi, 1809.

7) Echinostoma revolutum (Frölich, 1802) Looss, 1899.

Corvus corone corone L. (1st British record)

Corvus monedula L. (1st British record)

S.F. Himasthlinae Odhner, 1910.

Genus: Himasthla Dietz, 1909, emend. Odhner, 1910.

8) Himasthla rhigedana Dietz, 1909.

Numenius arquatus (L.) (1st British record)

Numenius phaeopus (L.) (1st British record)

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9) Himasthla leptosoma (Creplin, 1829) Dietz, 1909.

Calidris alpina (L.)

Tringa totanus L. (New Host record)

Arenaria interpres (L.)

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10) Himasthla elongata (Mehlis, 1831)

Larus argentatus L.

Family PHILOPHTHALMIDAE Travassos, 1918.

S.F. Parorchiinae Yamaguti, 1958.

Genus: Parorchis Nicoll, 1907.

11) Parorchis pittacium (Braun, 1901) Nicoll, 1907.

Larus marinus L.

Larus argentatus Pont.

Numenius arquatus (L.) (New Host record)

S.F. Echinostephillinae Yamaguti, 1958.

Genus: Echinostephilla Lebour, 1909.

12) Echinostephilla virgula Lebour, 1909.

Arenaria interpres (L.)

Family PRONOCEPHALIDAE Looss, 1902.

S.F. Pronocephalinae Looss, 1899.

Genus: Parapronocephalum Belopolskaya, 1952.

13) Parapronocephalum P. symmetricum Belopolskaya, 1953.

Arenaria interpres (L.) (1st European record)

Family CYCLOCOELIIDAE Kossack, 1911.

S.F. Cyclocoeliinae Stossich, 1902.

Genus: Cyclocoelum Brandes, 1892.

14) Cyclocoelum (Cyclocoelum) mutabile (Zeder, 1800) Dubois, 1959.

Gallinula chloropus (L.) (1st British record)

Fulica atra L. (1st British record)

15) Cyclocoelum (Hyptiasmus) elongatum Harrah, 1921.

Pica pica (L.) (1st British record)

Family BRACHYLAEMIDAE Joyeux & Foley, 1930.

S.F. Brachylaeminae Joyeux & Foley, 1930.

Genus: Brachylaemus Dujardin, 1843 emend. Blanchard, 1847.

16) Brachylaemus fuscatus (Rudolphi, 1819) Dujardin, 1843.

Corvus frugilegus L. (1st British record)

Corvus corone corone L. (1st British record)

Corvus monedula L. (New Host record)

Turdus merula L.

Sturnus vulgaris L.

Columba palumbus L.

Family LEUCOCHLORIDIIDAE Dollfus, 1934.

S.F. Leucochloridiinae Poche, 1907.

Genus: Leucochloridium Carus, 1835.

17) Leucochloridium certhiae McIntosh, 1927 (1st British record)

Certhia familiaris L. (New Host record)

Muscicapa striata Pallas. (New Host record)

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18) Leucochloridium melospizae McIntosh, 1932.

Sturnus vulgaris L. (New Host record)

Class - CESTODA

Order - Pseudophyllidea Carus, 1863.

Family DIPHYLLOBOTHRIDAE Lühe, 1910.

S.F. Ligulinae Lühe, 1910.

Genus: Ligula Bloch, 1782.

1) Ligula intestinalis (L) Bloch 1782. (1st Welsh record)

Podiceps cristatus (L) Latham 1789

Order - Tetrabothridea Baer, 1954.

Family TETRABOTHRIIDAE Braun, 1900.

Genus: Tetrabothrius Rudolphi, 1819.

2) Tetrabothrius cylindraceus (Rud., 1819) Diesing, 1850.

Larus marinus L. (1st British record)

Larus fuscus L. (1st British record)

Larus argentatus Pont.

Larus canus L.

Fratercula artica (L) Brisson 1760 (New Host)

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3) Tetrabothrius erostris (Lönnberg, 1889) Linstow, 1900.

Larus marinus L. (1st British record)

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4) Tetrabothrius immerinus (Abildgaard, 1790) Baer, 1954.

Podiceps cristatus (L) Latham, 1789 (1st British record)

Order - Cyclophyllidea Ben. in Braun, 1900.

Family DAVAINEIDAE Fuhrmann, 1907.

S.F. Davaineinae Braun, 1900.

Genus: Raillietina Fuhrmann, 1920.

5) Raillietina (Skrj.) bonini (Megnin, 1829) Fuhrmann, 1920.

Columba palumbus L.

Columba oenas L. (New Host)

S.F. Ophryocotylinae Fuhrmann, 1907.

Genus: Ophryocotyle Friis, 1870.

6) Ophryocotyle insignis Lönnberg, 1890.

Haematopus ostralegus L.

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7) Ophryocotyle proteus Friis, 1870.

Larus argentatus Pont. (1st European record)

Family DILEPIDIDAE Railliet and Henry, 1909.

S.F. Dilepidinae Fuhrmann, 1907.

Genus: Dilepis Weinland, 1858.

8) Dilepis undula (Schrank, 1788) Weinland, 1858.

Corvus corax L. (1st British record)

Corvus frugilegus L.

Corvus corone corone L.

Pica pica (L) (1st Welsh record)

Garrulus glandarius (L). Brisson, 1760.

Sturnus vulgaris L.

Turdus pilaris L. (1st Welsh record)

Turdus ~~melophilos~~ philomelos clarkii Hartert 1901.

Turdus merula L.

Turdus musicus L. (1st Welsh record)

Prunella modularis (L) Vieillot 1807 (1st Welsh record)

Larus argentatus Pont. (1st Welsh record)

Genus: Anomotaenia Cohn, 1900.

9) Anomotaenia constricta (Molin, 1858) Cohn, 1900.

Corvus corone corone L. (1st Welsh record)

Corvus monedula L. (1st Welsh record)

Turdus ~~melophilos~~ philomelos clarkii Hartert, 1901.

Turdus merula L.

Turdus musicus L. (1st Welsh record)

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10) Anomotaenia micracantha (Kr. 1869) Zschokke, 1903.

Larus marinus L.

Larus fuscus L.

Larus argentatus Pont.

Larus canus L.

Larus ridibundus L. (1st Welsh record)

Genus: Paricterotaenia Fuhrmann, 1932.

11) Paricterotaenia embryo (Kr. 1869) Fuhrmann, 1932.

Gallinago gallinago L. (1st British record)

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12) Paricterotaenia mariae Mettrick, 1958.

Erithacus rubecula melophilos Hartert, 1901 (1st Welsh record)

13) Paricterotaenia stellifera (Kr. 1869) Fuhrmann, 1932.

Scolopax rusticola L.

Gallinago gallinago L.

Lymnocryptes minimus (Brünnich) (New Host)

Genus: Trichocephaloides Sinitzin, 1896.

14) Trichocephaloides megalocephala (Kr., 1869) Clerc, 1903.

Calidris alpina (L.)

Genus: Gryporhynchus Nordmann, 1832.

15) Gryporhynchus retirostris (Kr., 1869) Belopolskaya, 1953.

Arenaria interpres L.

S.F. Dipylidiinae Stiles, 1896.

Genus: Choanotaenia Railliet, 1896.

16) Choanotaenia clavigera (Kr., 1869) Clerc, 1903.

Arenaria interpres L.

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17) Choanotaenia larimarina Elce, 1962.

Larus marinus L.

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18) Choanotaenia unicoronata (Fuhrmann, 1908) Fuhrmann, 1932.

Turdus merula L. (1st British record)

Family HYMENOLEPIDIDAE Railliet et Henry, 1909.

S.F. Hymenolepidinae Perrier, 1897.

Genus: Hymenolepis Weinland, 1858.

19) Hymenolepis (Hymenolepis) anatina (Krabbe, 1869) n.comb.

Anas platyrhynchos L. (1st British record)

Fulica atra L. (1st British record)

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20) Hymenolepis (Hym.) cirrosa (Krabbe, 1869) Baer, 1956.

Larus marinus L.

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21) Hymenolepis (Hym.) compressa (Linton, 1892) n.comb.

Aythya fuligula (L.) (1st Welsh record)

Anas crecca L. (1st Welsh record)

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22) Hymenolepis (Hym.) ductilis (Linton, 1927) Deblock et al. 1960.

Anas platyrhynchos L. (1st British record)

Somateria mollissima (L.) (1st British record)

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23) Hymenolepis (Hym.) farciminosa (Goeze, 1782) n. comb.

Garrulus glandarius (L.)

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24) Hymenolepis (Hym.) naja (Dujardin, 1845) n.comb.

Certhia familiaris L. (1st British record)

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25) Hymenolepis (Hym.) parina (Fuhrmann, 1907, a) n. comb.

Parus major L.	(1st British record)
Parus caerulus L.	(New Host)

26) Hymenolepis (Hym.) passeris (Gmelin, 1790) n. comb.

Sturnus vulgaris L.	(1st Welsh record)
Fringilla coelebs L.	(1st Welsh record)
Passer domesticus (L)	(1st Welsh record)
Parus major L.	(1st British record)
Parus palustris L.	(1st British record)
Aegithalos caudatus L.	(1st British record)

27) Hymenolepis (Hym.) rectacantha (Fuhrmann, 1906 b) Deblock et Rosé 1962.

Haematopus ostralegus L.

28) Hymenolepis (Hym.) serpentulus (Schrank, 1788) n. comb.

Corvus corax L.	(1st British record)
Corvus corone corone L.	
Corvus frugilegus L.	
Pica pica (L)	
Garrulus glandarius (L)	(1st Welsh record)
Turdus pilaris L.	(1st Welsh record)

29) Hymenolepis (Hym.) solowiow (Skrjabin, 1914) n. comb.

Aythya fuligula(L.)	(1st Welsh record)

30) Hymenolepis (Hym.) stylosa (Rudolphi, 1810) n.comb.

Corvus monedulae L. (1st Welsh record)

Pica pica (L.)

Garrulus glandarius (L.)

Sturnus vulgaris L. (1st Welsh record)

Parus ater britannicus (Sharpe and Dresser) (New Host)

Aegithalos caudatus L. (New Host)

Genus: Diorchis Clerc, 1903.

31) Diorchis acuminata (Clerc, 1902) Clerc, 1903.

Fulica atra L. (1st British record)

Genus: Aploparaksis Clerc, 1903.

32) Aploparaksis brachyphallos (Kr., 1869) Clerc, 1903.

Calidris canutus (L.) (1st British record)

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33) Aploparaksis crassirostris (Kr., 1869) Clerc, 1903.

Numenius arquatae (L.)

Numenius phaeopus (L.) (New Host)

Calidris alpina (L.)

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34) Aploparaksis dujardini (Kr., 1869) Clerc, 1903.

Corvus corax L. (New Host)

Sturnus vulgaris L.

Turdus pilaris L. (New Host)

Turdus musicus L.

Turdus merula L.

Prunella modularis (L.) (New Host)

Troglodytes troglodytes (L.) (New Host)

Motacilla alba yarrellii Gould (New Host)

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35) Aploparaksis filum (Goeze, 1782) Clerc, 1903.

Numenius arquatus (L)

Scolopax rustica L.

Gallinago gallinago L.

Tringa totanus L. (1st British record)

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36) Aploparaksis furcigera (Nitsch in Rud., 1819) Fuhrmann, 1908

Anas platyrhynchos L.

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37) Aploparaksis hirsuta (Kr., 1882) Clerc, 1903.

Gallinago gallinago L. (1st British record)

S.F. Fimbriariinae Wolffhügel, 1900.

Genus: Fimbriarioides Fuhrmann, 1932.

38) Fimbriarioides intermedia (Fuhr., 1913) Fuhrmann, 1932

Somateria mollissima (L.) (1st British record)

Unidentified spp.

39) Hymenolepis spp.

Aythya fuligula (L.)

40) Hymenolepis spp.

Gallinago gallinago L.

41) Dicranotaenia spp.

Aythya ferina (L.)

Melanitta nigra (L.)

42) Dilepis spp.

Sturnus vulgaris L.

43) Dilepis spp.

Ardea cinerea L.

Phylum ASCHELMINTHES Grobben, 1910

Class - NEMATODA (Rud., 1808)

Sub-Class Adenophoria (von Linstow, 1905) Chitwood, 1940.

Order Dorylaimida Pearse, 1936.

Sub-Order Dorylaimina (Chitwood, 1933) Pearse, 1936.

Superfamily Trichuroidea Railliet, 1916.

Family Trichuridae Railliet, 1915.

Sub-family Capillariinae Railliet, 1915.

Genus: Capillaria Zeder, 1800.

1) Capillaria caudinflata (Molin, 1858) Wavilowa, 1926.

Turdus merula L. (New Host)

Columba palumbus L. (1st Welsh record)

2) Capillaria contorta (Creplin, 1839) Travassos, 1914.

Turdus pilaris L.	(New Host)
Erithacus rubecula melophilos Hartert.	(1st British record)
Anthus pratensis (L.)	(New Host)
Anthus spinoletta (L.)	(1st established record)
Alauda arvensis L.	(New Host)
Anas platyrhynchos L.	(1st British record)
Numenius arquatus (L).	(1st British record)

3) Capillaria obsignata Madsen, 1945.

Turdus merula L.	(New Host)
Sturnus vulgaris L.	(New Host)

4) Capillaria ovopunctata (Von Linstow, 1873) Travassos, 1915

Turdus merula L.	(1st Welsh record)
Sturnus vulgaris L.	

5) Capillaria resecta (Dujardin, 1843) Travassos, 1915

Corvus frugilegus L.	(1st Welsh record)
Corvus monedula L.	
Corvus corone corone L.	(1st Welsh record)

6) Capillaria vanelli (Rudolphi, 1819) Chabaud, 1952.

Numenius arquatus (L.)	(New Host)
Vanellus vanellus (L).	(1st Welsh record)
Haematopus ostralegus L.	(1st Welsh record)

7) Capillaria spp.

Alauda arvensis L. (1st British record)

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8) Capillaria spp.

Carduelis flavirostris L. (New Host)

Sub-Class Secernentia (Von Linstow, 1905) Chitwood, 1940.

Order Stronylida

Super-family Strongyloidea (Weinland, 1858) Hall, 1916.

Family Syngamidae Leiper, 1912.

Genus: Syngamus Seibold, 1836.

9) Syngamus trachea (Montagu, 1811) Leiper, 1912.

Corvus frugilegus L.

Order Ascaridida

Super-family Ascaridoidea

Family Heterocheilidae Railliet et Henry, 1912.

Sub-family Filocapsulariinae Yamaguti, 1961.

Genus: Contracaecum Railliet et Henry, 1912.

10) Contracaecum spiculigerum (Rudolphi, 1809) Railliet et Henry, 1912.

Phalacrocorax aristotelis (L.)

Alca torda L. (1st British record)

Uria aalgae (Pont.) (1st British record)

Puffinus puffinus (Brünnich). (1st British record)

Larus fuscus L. (1st British record)

Genus: Porrocaecum Railliet et Henry, 1912.

11) Porrocaecum crassum (Deslongschamps, 1824) Railliet et Henry, 1912.

Anas platyrhynchus L. (1st Welsh record)

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12) Porrocaecum ensicaudatum (Zeder, 1800) Baylis, 1920.

Corvus frugilegus L.

Corvus corone corone L. (1st Welsh record)

Sturnus vulgaris L.

Turdus merula L.

Turdus pilaris L. (1st Welsh record)

Turdus musicus L. (1st Welsh record)

Turdus philomelos clarkii (Hartert)

Larus ridibundus L. (New Host)

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13) Porrocaecum semiteres (Zeder, 1800) Baylis, 1920

Vanellus vanellus (L.)

Charadrius apricarius L. (1st Welsh record)

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14) Porrocaecum spirale (Rudolphi, 1795) Baylis, 1920.

Athene noctua mira Witherby

Tyto alba (Scopoli) Billberg.

Order Spirurida

Super-family Spiruroidea

Family Physalopteridae Leiper, 1908.

Genus: Streptocara Railliet, Henry et Sissoff, 1912.

15) Streptocara tridentata (Von Linstow, 1877) Railliet, Henry et Sissoff, 1912.

Larus marinus L. (1st British record)

Family Acuariidae Seurat, 1913.

Genus: Seuratia Skrjabin, 1916.

16) Seuratia puffini Yamaguti, 1941.

Puffinus puffinus (Brünnich) (New Host) (1st European record)

Family Ancyracanthidae Railliet, 1916.

Sub-family Schistophorinae Travassos, 1918.

Genus: Viguiera Seurat, 1913.

17) Viguiera euryoptera (Rudolphi, 1819) Seurat, 1913.

Turdus merula L. (New Host) (1st British record)

MATERIAL AND METHODS

The birds were shot with a .12 shotgun and a .22 'Anschutz' rifle. The latter was modified to take .410 'shot' which proved ideal for small passerines within five feet of the barrel end. Permission to examine birds was granted by the Home Office and Pembrokeshire County Council allowed the writer to shoot on common ground. Many farmers willingly allowed use of the shotgun on their land but the rifle shooting was necessarily restricted to the areas agreed by the Chief Constable for the County. These were the woods and Home Farm on Hean Castle Estate, belonging to the Lord Merthyr, Bevalyn Farm, Saundersfoot and Trevayne Farm, Saundersfoot. Many birds were sent dead or dying if oiled, to the writer by bird lovers and farmers throughout the County and the West Wales Naturalist Trust gave permission for examination of birds on Skomer Island. Mr. David Sanders, the Warden, made many corpses of Great Black-backed Gulls and Lesser Black-backed Gulls available during his control of these species at the times of year when Puffins and Manx Shearwaters attempt to breed on the Island.

The most useful dishes for dissection proved to be small, jet-black plastic plates and saucers with deep rims, from Woolworths. These were of a useful size for a

thorough examination of small sections of the various body parts, held sufficient but not too much liquid, were easily packed into a knapsack and were cheap enough to make the odd breakage unimportant. Kilner jars of saline, small collecting bottles, plastic bags, quantities of newspaper and the Penguin Pocket Guide, 'Birds in Colour' completed the equipment for cycled journeys of up to one hundred miles per day in the summer months.

The principal places of recovery are indicated in the Map accompanying Part III which shows, in addition, the farms visited as part of the Poultry Survey.

Examination of birds took place as soon as possible after death. The hooks from the cestode scolices are shed within minutes of death when the host is an insectivorous bird and, as a general rule, death was followed by removal and examination of the alimentary canal. This was later stored in a bottle with washings from the coelomic cavity. The remains of each carcase was retained in plastic bags for further examination. Trematodes and nematodes are not so easily affected by the death of the host and the latter were frequently found to be living after two or three days. The only deviation from the

immediate removal and examination of the alimentary canal occurred on the odd occasions when it was necessary to return to Saundersfoot from Skomer Island. Additional sites of examination were the claws, bile ducts and gall bladder, kidney and urino-genital ducts, trachea, cloaca, head cavities (by cracking the skull and immersing in saline for several hours), the eye sockets and beneath the skin after plucking.

The usual treatment of the alimentary canal was division into appropriate lengths and careful opening in saline against a dark back-ground with strong illumination, from the rear end forwards. This method ensures against loss of the scolex since the less important gravid proglottids are encountered first. The gut of small birds was opened in its entirety. The lining of the gizzard was removed and the oesophagus pressed between slides. A hand lens was used for 'spotting' and later a pair of binoculars attached to a head strap which left the hands free for the collection of worms. After several washings and the removal of cestodes, trematodes and the obvious nematodes, the pieces of gut and washings were retained overnight during which time Capillaria species became opaque and could easily be picked out on re-examination.

Trematodes and cestodes were left to relax in chilled water, flattened between glass-plates and fixed in formol saline or acetic-alcohol. They were stored in 70% glycerine alcohol. Nematodes were dropped into hot alcohol and similarly stored. Care was taken not only to use different bottles for different hosts but also for differing portions of the alimentary canal. Staining was by Gower's carmine (occasionally aceto-carmine) for whole mounts and by Erhlich's Haematoxylin and Eosin for sections. Nematodes were examined successively in glycerine, lacto-phenol and beechwood creosote. The 'hanging-drop' technique was utilised for the mouth parts of the Porrocaecum spp.

Birds were identified principally by the 1952 edition of the British Ornithologists' Union 'Check List of Birds of Great Britain and Ireland' but reference was also made to Witherby et al., (1938) and several newer guide-books.

Interpretation. The number of hosts precedes the month, year and numbers examined at that particular time. e.g.
Eight - 8/60, 8/61(3), 7/62(4) means eight birds examined, one in August 1960, three in August 1961 and a further four in July 1962.
The helminths recovered are recorded -
Himasthla rhigedana Dietz, 1900.
(37(6) - 12/60, 1/62(2), 11/62(3).
Thus thirty seven trematodes were found in six hosts, one bird examined December, 1960, two more in January 1962 and a further three in November, 1962.

ORDER PODICIPIDITIFORMES

Family Podicipitidae

1) Podiceps cristatus (L.) Latham, 1789. (Great Crested Grebe)
One - 1/61
Cestode:- Tetrabothrius immerinus (Abildgaard, 1790)
(1(1) - 1/61).
Ligula intestinalis (L.)
(4(1) - 1/61).

ORDER PROCELLARIFORMES

Family Procellariidae

2) Puffinus puffinus (Brünnich) (Manx Shearwater)
Eight - 8/60, 8/61 (3), 7/62 (4).
Cestode:- Tetrabothrius cylindraceus (Rud., 1819)
(1(1) - 7/62).
Nematode:- Seuratia puffini Yamaguti, 1941
(25(8) - 8/60, 8/61(3), 7/62(4)).
Contracaecum spiculigerum (Rud., 1809)
(1(1) - 7/62).

ORDER PELICANIFORMES

Family Phalacrocoracidae

Phalacrocorax aristotelis (L.) Brisson, 1760. (Shag).
One - 11/63.
Nematode:- Contracaecum spiculigerum (Rud., 1809)

ORDER ARDEIFORMES

Family Ardeidae

4) Ardea cinerea Linnaeus, 1758. (Heron).

One - 1/63.

Cestode:- Dilepis spp.
(1(1) - 1/63)

ORDER ANSERIFORMES

Family Anatidae

S.F. Anatinae

5) Tadorna tadorna (L.) Fleming, 1822. (Shelduck)

One - 1/63.

No helminths recovered.

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6) Anas platyrhynchos Linnaeus, 1758. (Mallard)

One - 12/62.

Cestode:- Hymenolepis (H.) anatina (Krabbe, 1869)
(1(1) - 12/62)
Hymenolepis (H.) ductilis (Linton, 1927)
(2(1) - 12/62)
Aploparaksis furcigera (Rud., 1819)
(3(1) - 12/62)

Nematode:- Capillaria contorta (Creplin, 1839)
(3(1) - 12/62)
Porrocaecum crassum (Deslonchamps, 1824)
(2(1) - 12/62)

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7) Anas crecca Linnaeus, 1758. (Teal)

One - 12/63.

Cestode:- Hymenolepis (H.) compressa (Linton, 1892)
(1(1) - 12/63).

S.F. Nyrocinae.

8) Aythya fuligula Linnaeus, 1758. (Tufted Duck)

Two - 1/63, 2/63.

Cestode:- Hymenolepis (H.) compressa (Linton, 1892)
(1(1) - 1/63)

Aythya fuligula contd.

Hymenolepis (H.) solowiow (Skrjabin, 1914)
(2(1) - 2/63)
Hymenolepis spp.
(1(1) - 2/63).

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9) Aythya ferina Linnaeus, 1758. (Pochard)
One - 1/63.
Cestode:- Dicranotaenia spp.
(2(1) - 1/63).

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10) Somateria mollissima (L.) Leach, 1819. (Eider Duck)
One - 2/63.
Cestode:- Hymenolepis (H.) ductilis (Linton, 1927)
(3(1) - 2/63).
Fimbriariodes intermedia (Fuhrmann, 1913)
(8(1) - 2/63).

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11) Melanitta nigra (L.) Boie, 1822. (Common Scoter)
One - 11/62
Cestode:- Dicranotaenia spp.
(1(1) - 11/62)

ORDER RALLIFORMES
Family Rallidae

12) Gallinula chloropus (L.) Brisson, 1760. (Moorhen)
Two - 11/61
Trematode:- Cyclocoelum (C.) mutabile (Zeder, 1800)
(1(1) - 11/61).

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13) Fulica atra Linnaeus, 1758. (Coot).
Two - 1/62, 11/62.
Trematode:- Cyclocoelum (C.) mutabile (Zeder, 1800)
(1(1) - 1/62).
Cestode:- Hymenolepis (H.) anatina (Krabbe, 1869)
(2(1) - 1/62).
Diorchis acuminata (Clerc, 1902)
(5(1) - 11/62).

ORDER CHARADRIIFORMES

Family Haematopidae.

14) Haematopus ostralegus Linnaeus. (Oystercatcher).

Eleven - 7/60, 10/60 (2), 3/61, 7/61, 9/62, 12/62, 1/63(2), 2/63, 7/63.

Cestode:- Ophryocotyle insignis Lönnberg, 1890.
(60(3) - 7/60, 10/60 (2), 7/61, 9/62).
Hymenolepis (H.) rectacantha (Fuhrmann, 1906 b)
(3(1) - 3/61)

Nematode:- Capillaria vanelli (Rud., 1819)
(23(6) - 7/60, 12/62, 1/63(2),2/63, 7/63).

Family Charadriidae.

S.F. Vanellinae.

15) Vanellus vanellus (L.) Brisson, 1760. (Lapwing).

Five - 12/60, 1/61, 1/62 (2), 12/62.

Cestode:- Choanotaenia spp.
(3(1) - 12/62).

Nematode:- Capillaria vanelli (Rud., 1819)
(18(4) - 12/60, 1/61, 1/62, 12/62)
Porrocaecum ensicaudatum (Zeder, 1800)
(5(1) - 1/62)

S.F. Charadriinae.

16) Charadrius apricarius Linnaeus, 1758. (Golden Plover).

One - 1/63.

Nematode:- Porrocaecum semiteres (Zeder, 1800).
(3(1) - 1/63).

S.F. Arenariinae.

17) Arenaria interpres (L.) Brisson, 1760. (Turnstone)

Nine - 1/61, 12/61, 7/62, 11/62, 1/63, 2/63, 6/63, 8/63, 12/63.

Trematode:- Echinostephila virgula Lebour, 1909
(2(1) - 11/62).
Paraphonocephalum symmetricum Belopolskaya, 1952
(4(1) - 11/62).
Himasthla leptosoma (Creplin, 1829).
(4(1) - 7/62).

Arenaria interpres Contd.

Cestode:- Gryporhynchus retirostris (Krabbe, 1869)
(7(3) - 7/62, 11/62, 6/63).
Choanotaenia clavigera (Krabbe, 1869)
(15(7) - 1/61, 12/6, 7/62, 11/62, 6/63, 8/63, 12/63).

Family Scolopacidae.

S.F. Scolopacinae.

18) Gallinago gallinago Linnaeus, 1758. (Common Snipe).
Eight - 1/61, 12/61, 11/62(2), 12/62, 1/63 (3).
Cestode:- Paricterotaenia embryo (Krabbe, 1869)
(3(2) - 1/63)
Paricterotaenia stellifera (Krabbe, 1869).
(8(4) - 1/61, 11/62 (2), 1/63).
Aploparaksis parafilum (Goeze, 1782)
(15(7) - 1/61, 11/62(2), 12/62, 1/63)
Aploparaksis hirsuta (Krabbe, 1882)
(1(1) - 11/62).
Hymenolepis spp.
(5(1) - 1/61).

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19) Lymnocryptes minimus (Brünnich) Kaup, 1829. (Jack Snipe)
Two - 1/63.
Cestode:- Paricterotaenia stellifera (Krabbe, 1869)
(4(2) - 1/63)

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20) Scolopax rusticola Linnaeus, 1758. (Woodcock)
One - 12/63.
Cestode:- Paricterotaenia stellifera (Krabbe, 1869)
(4(1) - 12/63).
Aploparaksis filum (Krabbe, 1869)
(2(1) - 12/63)

S.F. Tringinae.

21) Numenius arquatae (L.) Brisson, 1760. (Curlew).
Nine - 11/60(2), 12/60, 1/61(2), 11/62(3), 12/62

Trematode:- Gymnophallus numenii sp. nov.
(6(1) - 11/60)
Parorchis pittacium (Braun, 1900)
(5(1) - 11/62)
Himasthla rhigedana Dietz, 1900
(37(6) - 12/60, 1/61(2), 11/62(3)).

Cestode:- Aploparaksis crassirostris (Krabbe, 1869)
(4(1) - 11/62)
Aploparaksis parafilum (Goeze, 1782)
(10(7) - 11/60, 12/60, 1/61(2), 11/62(3)).

Nematode:- Capillaria contorta (Creplin, 1839)
(2(1) - 12/62)
Capillaria vanelli (Rudolphi, 1819)
(14(3) - 1/61, 11/62, 12/62).

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22) Numenius phaeopus (L.) Brisson, 1760. (Whimbrel).
One - 12/62.

Trematode:- Himasthla rhigedana Dietz, 1900
(3(1) - 12/62)
Aploparaksis crassirostris (Krabbe, 1869)
(2(1) - 12/62)

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23) Tringa totanus (L) (?) (Redshank).
One - 1/62

Trematode:- Himasthla leptosoma (Creplin, 1829)
(3(1) - 1/62)

Cestode:- Aploparaksis filum (Krabbe, 1869)
(2(1) - 1/62)

S.F. Calidritinae.

24) Calidris canutus (L.) Anon., 1804. (Knot).
One - 1/63.

Cestode:- Aploparaksis brachyphallos (Krabbe, 1869)
(4(1) - 1/63)

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25) Calidris alpina (L.) Anon., 1804 (Dunlin).
Three - 3/62, 10/62, 12/63.
Trematode:- Himasthla leptosoma (Creplin, 1829)
(6(1) - 10/62)
Cestode:- Trichocephaloides megalocephala (Krabbe, 1869)
(1(1) - 3/62)
Aploparaksis crassirostris (Krabbe, 1869)
(2(1) - 10/62)

Family Laridae.

26) Larus marinus Linnaeus, 1758. (Great Black-backed Gull)
Thirty three - all seasons, 1960, 1961, 1962, 1963.
Trematode:- Gymnophallus deliciosus (Olsson, 1893)
(53(21) - all seasons 1960, 1961, 1962, 1963)
Parorchis pittacium (Braun. 1900)
(1(1) - 8/62)
Cestode:- Tetrabothrius cylindraceus (Rudolphi, 1819)
(67(21) - all seasons 1960, 1961, 1962, 1963)
Tetrabothrius erostris (Lönnberg, 1889)
(1(1) - 3/63)
Anomotaenia micracantha (Krabbe, 1869)
(10(8) - 8/60 (2), 8/61 (3), 7/62(3)).
Choanotaenia larimarina Elce, 1962
(30(1) - 3/61)
Hymenolepis (H.) cirrosa (Krabbe, 1869)
(3(1) - 3/61)
Nematode:- Streptocara tridentata (Linstow, 1877)
(1(1) - 7/62)

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27) Larus fuscus Linnaeus, 1758. (Lesser Black-backed Gull)
Nine - 8/60, 1/61, 7/62 (2), 8/62 (2), 1/63, 7/63(2)
Trematode:- Gymnophallus deliciosus (Olsson, 1893)
(14(7) - 8/60, 1/61, 7/62 (2), 8/62 (2), 7/63)
Cestode:- Anomotaenia micracantha (Krabbe, 1869)
(11(4) - 8/60, 7/62 (2), 7/63)
Tetrabothrius cylindraceus (Rudolphi, 1819)
(13(8) - 8/60, 7/62(2), 8/62 (2), 1/63, 7/63 (2)).

Larus fuscus Contd.

Nematode:- Contracaecum spiculigerum (Rudolphi, 1809)
(2(1) - 7/62)

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28) Larus argentatus Pontoppidan, 1763. (Herring Gull)
Seventeen - all seasons, 1960, 1961, 1962, 1963

Trematode:- Gymnophallus deliciosus (Olsson, 1893)
27(13) - all seasons 1960, 1961, 1962, 1963).
Himasthla elongata (Mehlis, 1831)
(6(1) - 4/62)
Parorchis pittacium (Braun, 1900)
(3(1) - 7/62)

Cestode:- Tetrabothrius cylindraceus (Rudolphi, 1819)
(9(4) - 4/62, 7/62, 8/62, 7/63)
Ophryocotyle proteus Friis, 1870.
(1(1) - 12/60)
Dilepis undula (Schrank, 1788)
(1(1) - 12/61)
Anomotaenia micracantha (Krabbe, 1869)
(numerous(11) - 1960, 1961, 1962, 1963)

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29) Larus canus Linnaeus, 1758 (Common Gull)
Five - 1/60(2), 1/62(3).

Trematode:- Gymnophallus deliciosus (Olsson, 1893)
(5(2) - 1/60, 1/62)

Cestode:- Tetrabothrius cylindraceus (Rudolphi, 1819)
(2(1) - 1/62)
Anomotaenia micracantha (Krabbe, 1869)
(5(2) - 1/62)

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30) Larus ridibundus Linnaeus, 1758 (Black-headed Gull)
Three - 12/61(2), 1/63.

Trematode:- Gymnophallus deliciosus (Olsson, 1893)
(2(1) - 12/61)

Cestode:- Anomotaenia micracantha (Krabbe, 1869)
(3(2) - 12/61, 1/63)

Larus ridibundus Contd.

Nematode:- Porrocaecum ensicaudatum (Zeder, 1800)
(2(1) - 1/63)

Family Alcidae

31) Alca torda Linnaeus, 1758 (Razorbill)
Two - 7/62
Nematode:- Contracaecum spiculigerum (Rudolphi, 1809)
(1(1) - 7/62)

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32) Uria aalgae (Pont.) Brisson, 1760 (Guillemot)
Two - 7/62
Nematode:- Contracaecum spiculigerum (Rudolphi, 1809)
(3(1) - 7/62)

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33) Fratercula artica Linnaeus, 1758. (Puffin)
Four - 7/62
Cestode:- Tetrabothrius cylindraceus (Rudolphi, 1819)
(1(1) - 7/62)

ORDER COLUMBIFORMES

Family Columbidae.

34) Columba palumbus Linnaeus, 1758. (Woodpigeon)
Thirty-four - all seasons 1960, 1961, 1962, 1963.
Trematode:- Brachylaemus fuscatus (Rudolphi, 1819)
(7(1) - 2/63)
Cestode:- Raillietina (Skrj.) bonini (Megnin, 1899)
(73(9) - 8/60, 10/61(3), 11/62(2), 9/63, 11/63(2))
Nematode:- Capillaria caudinflata (Molin, 1858)
(28(3) - 3/60, 9/62, 7/63).

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35) Columba oenas Linnaeus, 1758. (Stock Dove)
One - 8/62.
Cestode:- Raillietina (Skrj.) bonini (Megnin, 1899)
(3(1) - 8/62)

ORDER STRIGIFORMES

Family Strigidae

36) Athene noctua mira Witherby (Little Owl)

One - 2/61

Nematode:- Porrocaecum spirale (Rudolphi, 1793)
(3(1) - 2/61)

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37) Tyto alba (Scopoli) Billberg, 1828. (Barn Owl)

One - 11/63

Nematode:- Porrocaecum spirale (Rudolphi, 1793)
(1(1) - 11/63).

ORDER APODIFORMES

Family Apodidae.

38) Apus apus Linnaeus, 1758. (Swift).

One - 8/63

Trematode:- Plagiorchis maculosus (Rudolphi, 1802)
(9(1) - 8/63)

ORDER PICIFORMES.

Family Picidae

S.F. Picinae.

39) Dendrocopus major Linnaeus, 1758. (Great Spotted Woodpecker)

One - 3/63.

No helminths found.

ORDER PASSERIFORMES.

Family Alaudidae

40) Alauda arvensis Linnaeus, 1758. (Skylark)

Twelve - 8/62, 1/63 (10), 7/63.

Nematode:- Capillaria contorta (Creplin, 1839)
(1(1) - 7/63)
Capillaria spp.
(1(1) - 8/62)

Family Hirundinidae.

41) Hirundo rustica Linnaeus, 1758. (Swallow).

Two - 6/63.

Trematode:- Plagiorchis maculosus (Rud., 1802)
(58(2) - 6/63).

Family Corvidae.

42) Corvus corax Linnaeus, 1758. (Raven).

Two - 3/63.

Trematode:- Zoonorchis petiolatum (Railliet, 1900)
(1(1) - 3/63)

Cestode:- Dilepis undula (Schrank, 1788)
(3(2) - 3/63)

Hymenolepis (H.) serpentulus (Rudolphi, 1810)
(1(1) - 3/63)

Aploparaksis dujardini (Krabbe, 1869)
(2(1) - 3/63)

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43) Corvus corone corone Linnaeus, 1758. (Carrion Crow)

Eight - 4/60, 8/60, 12/60, 7/61, 1/62, 7/62, 1/63, 3/63.

Trematode:- Lyperosomum longicauda (Rudolphi, 1809)
(1(1) - 8/60)

Zoonorchis petiolatum (Railliet, 1900)
(1(1) - 11/60)

Echinostomum revolutum (Frölich, 1802)
(1(1) - 3/63)

Brachylaemus fuscatus (Rudolphi, 1819)
(2(1) - 4/60)

Cestode:- Dilepis undula (Schrank, 1788)
(10(3) - 8/60, 12/60, 1/62, 7/62, 1/63)

Anomotaenia constricta (Molin, 1858)
(3(1) - 7/61)

Hymenolepis (H.) serpentulus (Rudolphi, 1810)
(8(3) - 4/60, 8/60, 3/63)

Nematode:- Capillaria resecta (Dujarin, 1843)
(8(1) - 7/62)

Porrocaecum ensicaudatum (Zeder, 1800)
(5(1) - 1/63

44) Corvus frugilegus Linnaeus, 1758. (Rook)

Twenty-one - all seasons 1960, 1961, 1962, 1963.

Trematode:- Lyperosorum longicauda (Rudolphi, 1809)
(1(1) - 11/60)
Brachylaemus fuscatus (Rudolphi, 1819)
(3(1) - 1/60)

Cestode:- Dilepis undula (Schrank, 1788)
(29(10) - all seasons).
Hymenolepis (H.) serpentulus (Rudolphi, 1810)
(13(10) - all seasons).

Nematode:- Porrocaecum ensicaudatum (Zeder, 1800)
(25(11) - all seasons)
Capillaria resecta (Dujardin, 1843)
(numerous - 9 occasions)
Syngamus trachea (Montagu, 1811)
(6(1) - 7/62)

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45) Corvus monedula Linnaeus, 1758. (Jackdaw)

Eleven - 8/60(2), 7/61(2), 12/61(3), 3/63, 8/63, 12/63, 1/64.

Trematode:- Echinostoma revolutum (Frölich, 1802)
(2(1) - 8/63)
Brachylaemus fuscatus (Rudolphi, 1819)
(5(1) - 8/63)

Cestode:- Anomotaenia constricta (Molin, 1858)
(2(2) - 8/60, 12/61)
Hymenolpis (H.) stylosa (Rudolphi, 1809)
(9(5) - 8/60, 3/63, 8/63, 12/63, 1/64)

Nematode:- Capillaria resecta (Dujardin, 1843)
(numerous - 8 occasions)

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46) Pica pica (L.) Brisson, 1760. (Magpie)

Six - 1/61, 7/61, 6/62, 8/62, 12/62, 1/63

Trematode:- Lyperosmum longicauda (Rudolphi, 1809)
(1(1) - 7/61)
Zoonorchis petiolatum (Raillict, 1900)
(1(1) - 6/62)
Cyclocoelum (Hyptiasmus) elongatum Harrah, 1923
(3(1) - ?)

Pica pica Contd.

Cestode:- Dilepis undula (Schrank, 1788)
(8(3) - 1/61, 7/61, 6/62)
Hymenolepis (H.) serpentulus (Rudolphi, 1810)
(8(3) - 8/62, 12/62, 1/63)
Hymenolepis (H.) stylosa (Rudolphi, 1809)
(9(2) - 12/62, 1/63)

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47) Garrulus glandarius (L.) Brisson, 1760. (Jay).
Eight - 1/61, 7/61, 3/62, 12/62, 1/63(2), 3/63, 8/63.

Trematode:- Lyperosomum longicauda (Rudolphi, 1809)
(1(1) - 3/62)

Cestode:- Dilepis undula (Schrank, 1788)
(2(2) - 12/63, 3/63)
Hymenolepis (H.) farciminosa (Goeze, 1782)
(6(2) - 7/61, 12/62)
Hymenolepis (H.) serpentulus (Rudolphi, 1810)
(2(1) - 1/63)
Hymenolepis (H.) stylosa (Rudolphi, 1809)
(2(1) - 1/63)

Family Paridae.

48) Parus major Linnaeus, 1758. (Great Tit)
Two - 11/62, 4/60.

Trematode:- Lutztrema monenteron (Price and McIntosh, 1935)
(2(1) - 11/62)

Cestode:- Hymenolepis (H.) parina (Fuhrmann, 1907)
(2(1) - 4/60)
Hymenolepis (H.) passeris (Gmelin, 1790)
(1(1) - 11/62)

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49) Parus caerulus Linnaeus, 1758 (Blue Tit)
One - 8/60.

Cestode:- Hymenolepis (H.) parina (Fuhrmann, 1907)
(3(1) - 8/60)

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50) Parus ater britannicus Sharpe and Dresser, 1871. (Coal Tit)
Three - 8/62, 11/61, 3/62.
Cestode:- Hymenolepis (H.) parina (Fuhrmann, 1907)
(2(1) - 11/61)
Hymenolepis (H.) stylosa (Rudolphi, 1809)
(2(1) - 8/62)

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51) Parus palustris Linnaeus, 1758. (Marsh Tit)
One - 3/62.
Cestode:- Hymenolepis (H.) passeris (Gmelin, 1790)
(1(1) - 3/62)
Hymenolepis (H.) stylosa (Rudolphi, 1809)
(2(1) - 3/62)

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52) Aegithalos caudatus Linnaeus, 1758. (Long-tailed Tit)
Two - 11/61.
Cestode:- Hymenolepis (H.) passeris (Gmelin, 1790)
(2(1) - 11/61)
Hymenolepis (H.) stylosa (Rudolphi, 1809)
(1(1) - 11/61)

Family Certhidae.

53) Certhia familiaris Linnaeus, 1758. (Tree Creeper)
Two - 3/61, 1/62.
Trematode:- Leucochloridium certhiae McIntosh, 1927
(1(1) - 3/61)
Cestode:- Hymenolepis (H.) naja (Dujardin, 1845)
(1(1) - 1/62)

Family Troglodytidae

54) Troglodytes troglodytes (L.) Viellot, 1807. (Wren)
Two - 3/61, 8/62.
Cestode:- Aploparaksis dujardini (Krabbe, 1869)
(2(1) - 8/62)

Family Turdidae

S.F. Turdinae.

55) Turdus pilaris Linnaeus, 1758. (Fieldfare)

Six - 3/63.

Trematode:- Lyperosomum longicauda (Rudolphi, 1809)
(1(1) - 3/63)

Cestode:- Dilepis undula (Schrank, 1788)
(8(5) - 3/63)

Hymenolepis (H.) serpentulus (Rudolphi, 1810)
(5(4) - 3/63)

Aploparaksis dujardini (Krabbe, 1869)
(8(2) - 3/63)

Nematode:- Capillaria contorta (Creplin, 1839)
(5(1) - 3/63)

Porrocaecum ensicaudatum (Zeder, 1800)
(5(2) - 3/63)

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56) Turdus philomelos clarkii Hartert, 1901. (Songthrush)

Four - 1/61, 11/62, 6/63, 8/63.

Trematode:- Lyperosomum longicauda (Rudolphi, 1809)
(1(1) - 1/61)

Cestode:- Dilepis undula (Schrank, 1788)
(5(2) - 1/61, 6/63)

Anomotaenia constricta (Molin, 1858)
(13(1) - 8/63)

Nematode:- Porrocaecum ensicaudatum (Zeder, 1800)
(6(1) - 8/63)

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57) Turdus musicus Linnaeus, 1758. (Redwing)

Six - 3/63.

Trematode:- Luztrema monenteron (Price and McIntosh, 1935)
(1(1) - 3/63)

Zoonorchis petiolatum (Railliet, 1900)
(1(1) - 3/63)

Cestode:- Dilepis undula (Schrank, 1788)
(5(2) - 3/63)

Anomotaenia constricta (Molin, 1858)
(3(2) - 3/63)

Turdus musicus Contd.

Aploparaksis dujardini (Krabbe, 1869)
(11(4) - 3/63)

Nematode:- Porrocaecum ensicaudatum (Zeder, 1800)
(3(1) - 3/63)

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58) Turdus merula Linnaeus, 1758. (Blackbird)
Seven - 11/60, 4/61, 7/61, 1/62, 11/62, 3/63, 5/63.

Trematode:- Lyperosomum longicauda (Rudolphi, 1809)
(1(1) - 1/62)
Lutztrema monenteron (Price and McIntosh, 1935)
(5(3) - 11/60, 4/61, 1/62)
Brachylaemus fuscatus (Rudolphi, 1819)
(10(1) - 1/62)

Cestode:- Dilepis undula (Schrank, 1788)
12(4) - 11/60, 4/61, 1/62, 3/63)
Anomotaenia constricta (Molin, 1858)
(6(2) - 1/62, 11/62)
Choanotaenia unicoronata (Fuhrmann, 1908)
(2(1) - 1/62)

Nematode:- Aploparaksis dujardini (Krabbe, 1869)
(8(4) - 11/60, 4/61, 11/62, 5/63)
Capillaria caudinflata (Molin, 1858)
(5(1) - 11/62)
Capillaria obsignata Madsen, 1945.
(8(1) - 5/63)
Capillaria ovopunctata (Linstow, 1873)
(7(1) - 11/62)
Porrocaecum ensicaudatum (Zeder, 1800)
(9(3) - 4/61, 1/62, 5/63)
Viguiera euryptoptera (Rudolphi, 1819)
(3(1) - 3/63)

S.F. Phoenicurinae.

59) Oenanthe oenanthe (L.) Vieilliet, 1816. (Wheatear)
One - 7/62.

No helminths found.

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60) Erithacus rubecula melophilos Hartert, 1901. (Robin)
Three - 1/61, 1/62, 3/62.

Trematode:- Lutztrema monentereon (Price and McIntosh, 1935)
(1(1) - 1/62)

Cestode:- Paricterotaenia mariae Mettrick, 1938.
(2(1) - 1/61).

Nematode:- Capillaria contorta (Creplin, 1839)
(2(1) - 3/62).

S.F. Saxicolinae.

61) Saxicola torquata (L.) Bechstein, 1802. (Stonechat).
Two - 7/62, 8/63.

No helminths found.

Family Sylvidae.

62) Sylvia curruca (L.) Scopoli, 1768. (Lesser White-throat).
Two - 8/63.

Cestode:- Choanotaenia spp. (fragments).
(3(1) - 8/63).

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63) Phylloscopus collybita (Vielliot) Boie, 1836. (Chiffchaff)
One - 7/62

No helminths found.

Family Regulidae

64) Regulus regulus (L.) Cuvier, 1800. (Goldcrest)
Two - 3/61, 11/62.

No helminths found.

Family Musicapidae

63) Muscicapa striata Palas, 1764. (Spotted Flycatcher)
One - 6/62.

Trematode:- Leucochloridium certhiae McIntosh, 1927
(1(1) - 6/62)

Family Prunellidae.

66) Prunella modularis (L.) Viellot, 1810. (Hedge Sparrow)

Three - 11/61, 7/62, 1/63.

Cestode:- Dilepis undula (Schrank, 1788)
(1(1) - 7/62)

Aploparaksis dujardini (Krabbe, 1869)
(1(1) - 11/61)

Family Motacillidae.

67) Anthus pratensis (L.) Bechstein, 1803. (Meadow Pipit)

Four - 11/61, 7/62, 10/62, 4/63.

Nematode:- Capillaria contorta (Creplin, 1839)
(1(1) - 7/62)

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68) Anthus spinoletta (L.) Bechstein, 1803. (Rock Pipit)

Two - 8/62, 10/62.

Nematode:- Capillaria contorta (Creplin, 1839)
(1(1) - 10/62)

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69) Motacilla alba varrellii Gould, 1837. (Pied wagtail)

One - 8/63.

Cestode:- Aploparaksis dujardini (Krabbe, 1869)
(1(1) - 8/63)

Family Sturnidae.

70) Sturnus vulgaris Linnaeus, 1758. (Starling)

Two hundred plus - winter 1960, 1961, 1962, 1963, 1964.

Trematode:- Brachylaemus fuscatus (Rudolphi, 1819)
(3(1) - 10/60)

Leucochloridium melospizae McIntosh, 1932.
(13(1) - 1/61)

Cestode:- Dilepis undula (Schrank, 1788)
(100 plus (100 plus) - 1960, 1961, 1962, 1963)

Dilepis spp.
(1(1) - 12/61)

Hymenolepis (H.) passeris (Gmelin, 1790)
(8(6) - 12/61(2), 12/64 (4))

Hymenolepis (H.) stylosa (Rudolphi, 1809)

(6(3) - 12/62(4), 12/63)

Aploparaksis dujardini (Krabbe, 1869)

(30 plus (30 plus) - 1960, 1961, 1962, 1963)

Nematode:- Capillaria obsignata Madsen, 1945

(3(1) - 1/63)

Capillaria ovopunctata (Linstow, 1873)

(8(1) - 12/63)

Porrocaecum ensicaudatum (Zeder, 1800)

8(2) - 12/62, 1/63)

Family Fringillidae.

S.F. Coccothraustinae.

71) Chloris chloris (L.) Cuvier, 1800 (Greenfinch)

Two - 8/61, 8/63.

No helminths found

S.F. Fringillinae.

72) Carduelis carduelis britannicus Hartert, 1903 (Goldfinch)

Two - 12/63

No helminths found

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73) Carduelis cannabina (L.) Brisson, 1760 (Linnet)

One - 7/63.

No helminths found

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74) Carduelis flavirostris Linnaeus, 1758 (Twite)

Carduelis flavirostris Contd.

Nematode:- Capillaria spp.

(1(1) - 8/63)

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75) Carduelis flammea Linnaeus, 1758. (Redpoll)

One - 9/63

No helminths found.

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76) Pyrrhula pyrrhula (L.) Brisson, 1760. (Bullfinch)

Two - 12/62.

No helminths found.

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77) Fringilla coelebs Linnaeus, 1758. (Chaffinch)

Six - 1/61, 7/61, 8/62, 12/62, 1/63, 3/63.

Cestode:- Hymenolepis (H.) passeris (Gmelin, 1790)

(3(1) - 7/61)

S.F. Emberizinae.

78) Emberizia citrinella Linnaeus, 1758. (Yellow Hammer)

Four - 6/61, 8/61, 7/62, 8/62.

No helminths found.

Family Passeridae.

79) Passer domesticus (L.) Brisson, 1760. (House Sparrow)

Forty - all seasons, 1960, 1961, 1962, 1963

Trematode:- Lutztrema monenteron (Price and McIntosh, 1935)

(1(1) - 8/63)

Cestode:- Hymenolepis (H.) passeris (Gmelin, 1790)

(2(1) - 1/60

PART I. Section A.

Phylum PLATYHELMINTHES

Class Trematoda

The species were identified with the use of Dawes (revised edition, 1956) and Yamaguti (1958). Any departure from these texts is accounted for under the appropriate species. The newer classifications involving the pattern of the excretory system seem not to be acceptable to most taxonomists and are discarded. Due to photographic necessity, the text figures appear slightly re-arranged on certain plates. Thus Figures 8 and 10 appear on Plate 7 (page 109), Figures 9 and 12 on Plate 8 (page 113) and Figures 11 and 13a and b, on Plate 9 (page 122).

Order - DIGENEA

FAMILY: PLAGIORCHIDAE Ward, 1917

S.F.: Plagiorchiinae Pratt, 1902

Genus: Plagiorchis Lühe, 1899

Syns. Lepoderma Looss, 1899
Multiglandularis, Schulz and Skworzow, 1931
Neolepoderma Mehra, 1937
Plagiorchoides Olsen, 1937
Choristogonoporus Stunkard, 1938

The genus Plagiorchis was created by Lühe to incorporate many of the distomes from fish, reptiles, birds and mammals which had been described throughout the previous century. He proposed Plagiorchis lima (Rud., 1809) Lühe, 1899 from the Long-eared Bat (Vespertilio auritus) as the type. His diagnostic characters for the genus are long-oval body, oesophagus short or missing, genital opening at a distance from the intestinal bifurcation but only a little way in front of the ventral sucker and a little to the left of the midline. Cirrus sac to the right, around the ventral sucker with a large seminal vesicle. Testes, round-oval, one posterior. Round ovary alongside the hind end of cirrus sac. Receptaculum seminis absent. Uterus passing between the testes and ovary and filling the hind end of the body.

In the same year, 1899, Looss, who was working on the various species from mammals, proposed the name Lepoderma. He failed to name a genotype and as a result the rather later generic name of Lühe has assumed priority. Authors who have acknowledged Looss' precedence include Mehra (1937) with his generic name Neolepoderma, Baylis (1939) Lepoderma maculosa

from Britain, Callot (1946) with his redescription of Lepoderma maculosa, while Nicoll (1923) and Dollfus (1949) both state family Lepodermatidae, Odhner 1910, with Plagiorchidae as a synonym.

Pratt (1902) in North America proposed the sub-family Plagiorchiinae, but it was not until 1917 that a fellow North American worker, Ward, raised the sub-family to family status - Plagiorchidae.

In 1931, Schulz and Skworzow described a new species, Plagiorchis arvicolae, from the Water-rat (Arvicola amphibius (L.)) and revised the genus to include two subgenera. The subgenus Multiglandularis had as its chief diagnostic character the meeting of the vitellaria in front of the ventral sucker. The type species is P. multiglandularis Semenov. The date of Semenov's original description is not certain, Schulz and Skworzow giving 1922 (p.771), 1907 (p.773) while Yamaguti (1958) gives 1927. Since its official publication date, for the West at least, seems to be Semenov (1927), Yamaguti would appear to be correct. The other subgenus, Plagiorchis, is dependent on the vitellaria not meeting in front of the ventral sucker. The type species given was P. vespertilionis (Müller 1784), Braun 1900. Dubois (1955) regards this species as the type of the genus and the accepted type, P. lima (Rud., 1809), as a synonym. Lühe (1909, p.109) also gives Distomum lima Rud., as a synonym of Müller's vespertilionis. There are seven species, two from fish, three from reptiles and two from mammals that Schulz and Skworzow were unable to place in either sub genus.

Numerous authors have since stated that the coalescence of the vitellaria in front of the ventral sucker is inconstant in one and the same species. Among recent examples are Bykhovskaya-Pavlovskaya, 1953, fig. 3; Fedorova, 1954; Furmaga, 1956, p.583; Erhardova, 1958, fig. 1 and 6. It is considered that this feature changes with age.

The following year Schulz (1932) in a paper dealing with Plagiorchis species from rodents, stated the desirability of revising the entire genus. A subsequent attempt was that of Olsen (1937), who published a systematic study of the sub-family Plagiorchiinae Pratt, 1902, which included forty-three species and two sub-species. His key is dependent upon characters which, from the various descriptions and redescriptions, are subject to an amount of variation that makes it unsatisfactory to use. Olsen proposed the genus Plagiorchoides to incorporate P. noblei Park, 1936, which possess a receptaculum seminis, Lühe (1899) having given the absence of a receptaculum seminis as a character of the genus. Olsen's paper was published on August 7th., and just previous to this on July 23rd. Mehra (1937) had proposed Neolepoderma for P. noblei Park, 1936. Baer (1943) stated that the presence of a receptaculum seminis is characteristic of the genus, but neither Angel (1959) nor the writer have found it in serial sections of P. maculosus (Rud., 1802).

Yamaguti (1958) lists seven species from reptiles, forty-eight species from birds and twenty-seven species from mammals.

Skrjabin and Antipin (1958) give descriptions and figures

of forty species and a variety for the subgenus Plagiorchis and thirty-seven species and a variety for the subgenus Multiglandularis. Their publication is strongly criticized by Dollfus (1960).

The most recent study is that of Odening (1959), who has eliminated those species from the sub-family Plagiorchiinae where the vitellaria do not reach the posterior tip of the body. His classification of the subgenus Plagiorchis contains four groups of species as follows:-

a) vespertilionis group: 4 species and 2 sub-species
b) maculosus group: 1 species and 2 sub-species
c) elegans-triangularis group: 4 species and 2 sub-species
d) 4 species not included in the previous groups

while his classification of subgenus Multiglandularis has three groups:-

a) cirratus-laricola group: 6 species and 3 sub-species
b) multiglandularis group: 1 species and 2 sub-species
c) notabilis-muris group: 4 species and 4 sub-species

I). Plagiorchis maculosus (Rud., 1802) Braun, 1901

Fasciola hirundinus was described from the rectum of the Swift, Hirundino apus (now Apus apus L.) by Fröhlich in 1791. Within a few years Zeder (1800) described Distoma hirundinum from the House-Martin (Delichon urbica urbica (L.)). Rudolphi (1802) synonymised these two species with his own species Fasciola maculosa from the hind part of the intestine of the Swallow (Hirundino rustica L.) but gave no reason for not accepting

Fröhlich's specific name. Later he referred to Distoma maculosa (1819) and recorded it from the Nightjar (Caprimulgus europeaus L.). In 1901 Braun examined Rudolphi's material and that of other workers in the previous century and assigned it to the genus Plagiorchis Lühe, 1899. The following year he published a figure and brief description.

The first satisfactory description of P. maculosus and key to six species of Plagiorchis (four of which are from birds) is that of Lühe (1909). Since this date, redescriptions have been made by Yamaguti (1935, 1939, 1943), Callot (1946) who used the generic name Lepoderma, Strenzke (1952) and Angel (1959). The measurements recorded are shown, together with the total variation in Angel's Table I, and the variation of a random sample of fifteen of the writer's specimens in Table 3. The varieties of P. maculosus (var. anatis Skrjabin, 1928, var. citelli Schulz, 1932 and var. motacillae Yamaguti, 1939) are discussed by Angel (1959), who suggests that var. citelli and var. motacillae should be regarded as synonyms of var. anatis.

The life-history has been investigated by Nöller and Ullrich (1927), Strenzke (1952) and Angel (1959).

Surprisingly, for a trematode with such a world-wide distribution, the writer has been able to trace only one previous record from Britain. This is Baylis (1939) who recorded Lepoderma maculosa from the Swift. The writer's specimens were obtained from the Swallow (fifty-eight in two hosts - June 1963) and from the Swift (nine in a single bird -

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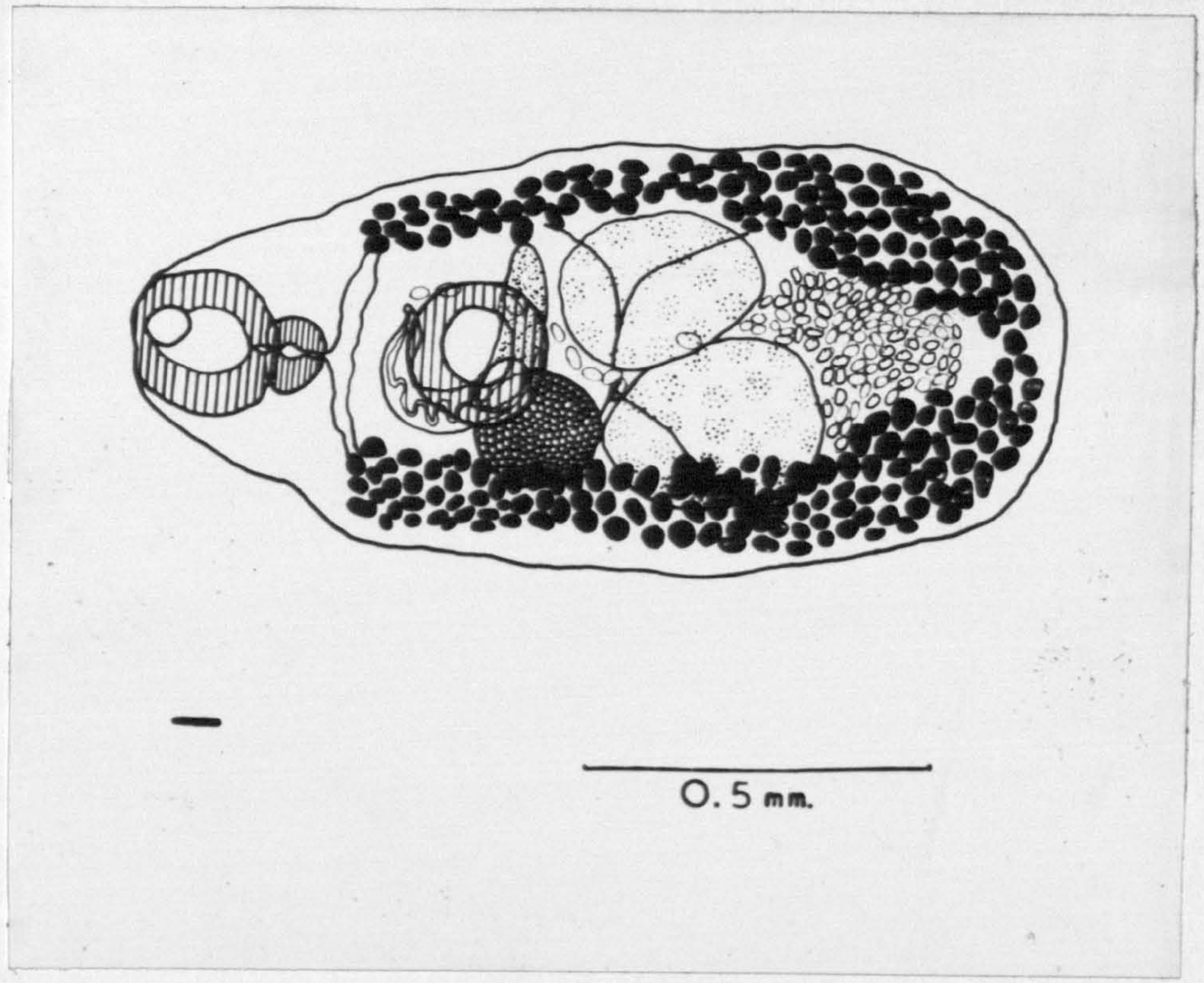
Plate 1

Plagiorchis maculosus (Rud., 1802)

Figure 1. Complete specimen.


0.5 mm.

August 1963). A random selection of twenty specimens were stained and mounted and serial sections were made from a further three.

External Morphology

The trematodes are oval-to-elongate and rounded at both ends. There were no conspicuous differences between the specimens from the two hosts, in fact, with the exception of one or two immature worms, there is a definite uniformity of size amongst the sixty-seven worms recovered. Figure 1 shows a fairly typical specimen, but the variation in organs is considerable despite the fact that the worms were not subjected to any fixation or to flattening. These variations will be referred to, and compared with the measurements of previous workers, given in Table 3, throughout the text.

The length of the specimens is remarkably constant, the smallest and least mature individual (approximately thirty eggs in the uterus) measuring 0.96 mm. long and 0.284 mm. wide, and the largest individual only 1.372 mm. long and 0.574 mm. wide. This is in contrast to the measurements provided by Yamaguti (1939) and Angel (1959). The cuticle is thickly set with small, slightly-curved, backwardly-directed spines, which cease at the posterior end of the hindmost testis. The spines are 0.006 mm. long and 0.003 mm. at the base. At the anterior end of the body they are in parallel rows, each spine being separated from its neighbour in the row by 0.003 mm. and from the adjacent row by 0.003 mm. In the posterior testis region

the spines are 0.012 mm. apart and the adjacent rows which show alternate spination are separated by 0.016 mm. The spination of the cuticle is omitted by Angel (1959) in her amended diagnosis of the species (p.268).

The oral sucker is muscular and terminal or occasionally subterminal. Olsen (1937) in his key states that it is subterminal in maculosus. Rudolphi (1809) said that it is terminal and Angel (1959) confirms this. Of the specimens stained and mounted by the writer, about 75% are terminal. Examination of unstained specimens mounted in glycerine jelly without a coverslip revealed that some 90% of the specimens have terminal openings to the oral sucker, the remaining 10% showing slight contraction of the anterior end at death which accounted for the subterminal opening. The measurements varied between 0.132 - 0.25 mm. long and 0.132 - 0.25 mm. wide. The sucker is, in general, perfectly round, but in particular individuals it may be longer than wide, as in Figure 1 of both Angel and the writer.

The muscular ventral sucker is one-third to one-half the body length away. It is globular more often than not, but in some specimens may be longer than wide. The writer's specimens show a variation of 0.165 - 0.25 mm. long and 0.132 - 0.215 mm. wide. It is therefore equal to or slightly larger than the oral sucker. Angel in her Figure I and in her species' diagnosis states 'suckers about the same, or oral slightly larger than acetabulum'. From Table 3 it can be seen that Yamaguti (1939) and Callot (1946) found the ventral sucker to be the larger of

the two. A curious feature in some 80% of the worms was the eversion of the cuticular lining of the ventral sucker, with a resulting 'mushroom' shape. This has been observed in no other species of trematode and careful examination showed that there are no glandular or adhesive properties incorporated in this structure.

Internal Morphology

a) Alimentary canal

The pharynx appears in all specimens to overlap the oral sucker, no prepharynx or folds which might represent an inverted tube being found. Angel stated 'prepharynx, if present, very short'. The pharynx is very muscular and is 0.075 - 0.102 mm. long and 0.068 - 0.08 mm. wide. The wall thickness is 0.03 - 0.035 mm. An oesophagus could not be distinguished in any specimen and the bifurcation of the intestine takes place immediately. Each caecum extends to within 0.1 mm. of the posterior end. It is 0.03 - 0.036 mm. in diameter at the anterior end and is obscured by the vitellaria for most of its length.

b) Musculature

The cuticle is 0.006 - 0.008 mm. thick and beneath it is found the usual arrangement of muscle fibres. The outer circular, the inner longitudinal, and oblique layers are all one fibre thick and there is no increase in density in the anterior region except immediately adjacent to the two suckers. This contrasts with the more active trematodes.

c) Excretory system

The Y-shaped vesicle opens terminally and extends for over a third of the body. The branch of the Y is found at a level with the front end of the posterior testis.

d) Reproductive system - Male

The testes are found obliquely in the posterior half of the body. There is much variation in size, for in some individuals they are equal, in one or two the anterior may be slightly larger, but in the majority the posterior testis is rather larger than the anterior. In shape they can be perfectly round, but more usually are elongate (Figure 1). The anterior testis was found to be 0.226 - 0.298 mm. long and 0.212 - 0.27 mm. wide, and the posterior testis was 0.226 - 0.33 mm. long and 0.212 - 0.273 mm. wide. Angel (1959) and Callot (1946) both found that in most instances the posterior testis is the larger of the two, but Yamaguti (1935, 1939, 1943) found them to be of equal size. The posterior testis is on the right, behind the ovary.

The vas efferens arises from the anterior ventral side of each testis and unites with its fellow to form the vas deferens at a short distance behind the cirrus sac. Previous workers have given very varied descriptions of the cirrus sac and Angel suggests that its size and shape are variable, depending on the contraction of the animal and the extent to which the cirrus is extruded. It is possible that the uniformity of the cirrus sac in the writer's specimens is due to the lack of fixation and the avoidance, wherever possible,

of any form of flattening. However, even in the specimens in which the cirrus is everted, there is only a slight variation in the bulk of the cirrus sac. The cirrus is elongate and broadest at the posterior end in the region of the internal seminal vesicle. There is no external seminal vesicle. It is from 0.447 - 0.65 mm. long and 0.055 - 0.065 mm. wide in the seminal vesicle region. The seminal vesicle is 0.166 - 0.2 mm. long, that is roughly one-third of the total length of the cirrus sac. The pars prostatica could not be observed, even in the serial sections. The flask-shaped ductus ejaculatorius leads into the cirrus itself. In the largest cirrus sac the 'flask' was 0.06 mm. long by 0.043 mm. wide. It is thin walled and in section was seen to consist of the usual arrangement of circular and longitudinal muscles, very sparsely distributed. In the cirrus region, the sac is 0.03 mm. in diameter. In the specimens in which the cirrus is everted it was found to lack spines and have a uniform diameter of 0.015 - 0.017 mm. The maximum eversion recorded from any specimen was 0.332 mm., Angel recording only 0.245 mm. The cirrus opens into the genital atrium, which is to the left of the midline, while the body of the cirrus passes dorsally or even round the ventral sucker on the right-hand side.

e) Reproductive system - Female

The ovary is on the right-hand side, adjacent to the cirrus sac and in line with the posterior testis. It is smaller than the testes and is frequently perfectly round, but is more usually longer than wide. The measurements taken were:

length, 0.142 - 0.201 mm.; diameter, 0.142 - 0.181 mm. Yamaguti (1943) records a slightly greater diameter than length.

The oviduct arises postero-dorsally from the ovicapt and passes indirectly backwards into Mehlis' gland. Laurer's canal, if present, could not be traced. Just before entering Mehlis' gland, the ovary receives the yolk duct from the small, ventral yolk reservoir. The central chamber of Mehlis'gland has a diameter of 0.03 mm. From the anterior end of Mehlis' gland, the uterus takes a somewhat convoluted course backwards between the testes to reach the posterior end. It turns sharply forward and again passes between the testes whence, after some further convolutions, it continues, dorsal to the ventral sucker, as the thick-walled metraterm. The metraterm (diameter 0.03 - 0.04 mm.) is about 0.25 mm. long and opens into the genital atrium alongside the cirrus sac. There is no receptaculum seminis. The vitellaria are found laterally and extend to the ventral sucker or just beyond it. Each follicle is approximately 0.045 mm. in diameter and the glands converge posteriorly. In newly mature specimens they extend even to the pharynx.

The eggs, which are found singly in the uterus, are 0.034 - 0.039 mm. long by 0.018 - 0.02 mm. wide. The egg sizes are larger than those recorded by Angel, although Yamaguti (1939, 1943) also recorded eggs up to 0.039 mm. in length.

Discussion

The variable nature of the body of P. maculosus (Rud., 1802) and its component organs is obvious from the above

TABLE: 3 **Plagiorchis maculosus** (Rud., 1802) Braun, 1901

Characters	Yam., 1935	Yam., 1939	Yam., 1943	Callot, 1946	Angel, 1959	Author
Length	1.6 - 1.92	1.6 - 3.9	1.6 - 2.5	2.35 - 2.5	0.9 - 3.2	0.96 - 1.372
Breadth	0.57 - 0.7	0.56 - 1.25	0.52 - 1.0	0.8 - 0.85	0.27 - 0.85	0.284 - 0.574
Oral Sucker	0.2 - 0.25	0.2 - 0.34	0.19 - 0.3 X 0.2 - 0.3	0.3	0.18 - 0.33 X 0.18 - 0.37	0.132 - 0.25 X 0.132 - 0.25
Ventral Sucker	0.2 - 0.25	0.2 - 0.35	0.19 - 0.3 X 0.2 - 0.3	0.25 - 0.32	0.15 - 0.3 X 0.15 - 0.28	0.165 - 0.25 X 0.132 - 0.215
Pharynx	-	0.08 - 0.18	-	-	-	0.075 - 0.102
Anterior Testis	0.25	0.22 - 0.5 X 0.18 - 0.43	0.2 - 0.35 X 0.2 - 0.35	0.34 x 0.3	0.13 - 0.35 X 0.11 - 0.26	0.226 - 0.298 X 0.212 - 0.27
Posterior Testis	0.25	0.22 - 0.5 X 0.18 - 0.43	0.2 - 0.35 X 0.2 - 0.35	0.35 x 0.26	0.13 - 0.42 X 0.11 - 0.3	0.226 - 0.33 X 0.212 - 0.273
Cirrus Sac	-	-	-	-	-	0.447 - 0.650 X 0.055 - 0.065
Ovary	0.16 - 0.22 X 0.14 - 0.16	0.16 - 0.34 X 0.13 - 0.3	0.15 - 0.28 X 0.17 - 0.29	0.3	0.11 - 0.28 X 0.9 - 0.22	0.142 - 0.201 X 0.142 - 0.181
Eggs	0.032 - 0.036 X 0.02 - 0.024	0.03 - 0.039 X 0.018 - 0.024	0.03 - 0.039 X 0.018 - 0.021	0.03 -- 0.032 X 0.02	0.029 - 0.031 X 0.017 - 0.02	0.034 - 0.039 X 0.018
Vitellaria	level	or	just	in	front	of Ventral Sucker

Strenzke (1952) gave the following measurements:

Length - 1.6 - 2.0

Breadth - 0.5 - 0.8

Egg - 0.034 - 0.036
X
0.021 - 0.023

redescription and this remains true even when care is taken not to cause variation through the use of different fixation media and not to subject the worm to excessive flattening when mounting. That an overall uniformity of the species is discernible from Table 3 does not make negative the need for a thorough examination of the genus, however. Whether maculosus is a valid species, or will fall in this revision cannot be stated here since the writer has had no opportunity to extend his study to other species.

The redescription is the first from material found in the British Isles and the Swallow is a new host record for Britain. The trematode has not previously been recorded from Wales.

Some Plagiorchis spp. were given to the writer by Mr. F.L. Clark of this Department, who recovered them from a Meadow Pipit (Anthus pratensis L.) near Dartford, Kent. As the work in hand is related to birds from South Wales, they have not yet been given critical attention. It is worth noting that the Meadow Pipit is a new host record.

FAMILY: DICROCOELIIDAE Odhner, 1910

S.F.: Dicrocoeliinae Looss, 1899

Tribe: Lyperosomini Yamaguti, 1958

Genus: Lyperosomum Looss, 1899

Syns. Oswaldoia Travassos, 1919

Dicrocoelioides Dollfus, 1954

The genus Lyperosomum was created by Looss (1899) with Distoma longicauda Rudolphi, 1809 as type species. The generic diagnosis given was: body greatly elongated, more or less circular in cross-section, testes in tandem behind the ventral sucker, ovary behind the testes, vitellaria consisting of small follicles on either side, in the liver (gall-bladder) and intestine of birds and mammals.

Various species now included in the genus have been placed previously in Oswaldoia Travassos, 1919 and Dicrocoelioides Dollfus, 1954. In 1957, Dollfus withdrew the generic name Dicrocoelioides and placed the incorporated species into Oswaldoia. Yamaguti (1958) has synonymised both these genera with Lyperosomum Looss, 1899.

2). Lyperosomum longicauda (Rud., 1809) Braun, 1902

Syns. Distoma longicauda Rudolphi, 1809

Distoma macrourum Rudolphi, 1819

Dicrocoelium longicauda Looss, 1899

Rudolphi (1809) described Distoma longicauda from the gall-bladder of the Hooded Crow (Corvus cornix cornix L.) and in

1819, a second parasite from this host, Distoma macrourum. Braun (1902) re-examined the type material and declared that the egg size was the same and therefore macrourum is a synonym of longicauda.

There are many European hosts for this species amongst which are the Blackbird (Turdus merula L.), the Songthrush (Turdus philomelos L.), the Carrion Crow (Corvus corone corone L.), the Rook (Corvus frugilegus L.), the Jay (Garrulus glandarius (L.)), the Magpie (Pica pica (L.)), the Eastern Nightingale (Luscinia luscinia (L.)), the Starling (Sturnus vulgaris L.), the Tree Pipit (Anthus trivialis (L.)), the Red-backed Shrike (Lanius collurio L.) and the Golden Eagle (Aquila heliaca Savigny).

The first British record is that of Baird (1853) in the Songthrush, and Nicoll (1923) added the Jay. Davies (1937 - unpubl.) recorded it from the Blackbird, while Mettrick (1958) and Williams (1962) recorded it from the Rook. Davies (1958) found the species in the Jackdaw.

The writer has found solitary specimens in each of the following hosts: the Rook (Nov., 1960), the Carrion Crow (Aug., 1960), the Magpie (July, 1961), the Jay (March, 1962), the Songthrush (Jan., 1961), the Blackbird (Jan., 1962) and the Fieldfare (March, 1963).

External Morphology

The body is very much elongated and is rounded at both ends, 8 - 10.5 mm. long and widest between the ventral sucker

and the anterior testis, 0.95 - 1.2 mm. The cuticle is thin, 0.005 mm. and unarmed. The oral sucker is terminal, 0.35 - 0.42 mm. in diameter and at a distance of 1.6 mm. is the ventral sucker, which is twice as large as the oral sucker, 0.75 - 0.8 mm. The opening of the oral sucker is 0.15 mm. and of the ventral sucker, 0.4 mm. (Figure 2).

Internal Morphology

a) Alimentary canal

There is no prepharynx, the small pharynx following on from the oral sucker, 0.18 - 0.19 mm. by 0.23 mm. A short oesophagus, 0.25 mm., bifurcates into two lateral caeca which have a diameter of 0.035 mm. and extend to near the posterior tip of the body, where their termination is obscured by the uterus.

b) Musculature

Serial sections were not made, all the specimens being mounted for identification.

c) Excretory system

There is a terminal pore which leads into an elongate excretory vesicle, the precise length of which could not be estimated because of the many convolutions of the uterus.

d) Reproductive system - Male

The oval testes are found in tandem behind the ventral sucker and are separated by the coils of the uterus. They are almost equal in size, 0.51 mm. by 0.48 - 0.5 mm. The vas deferens is 0.015 mm. in diameter and crosses dorsal to

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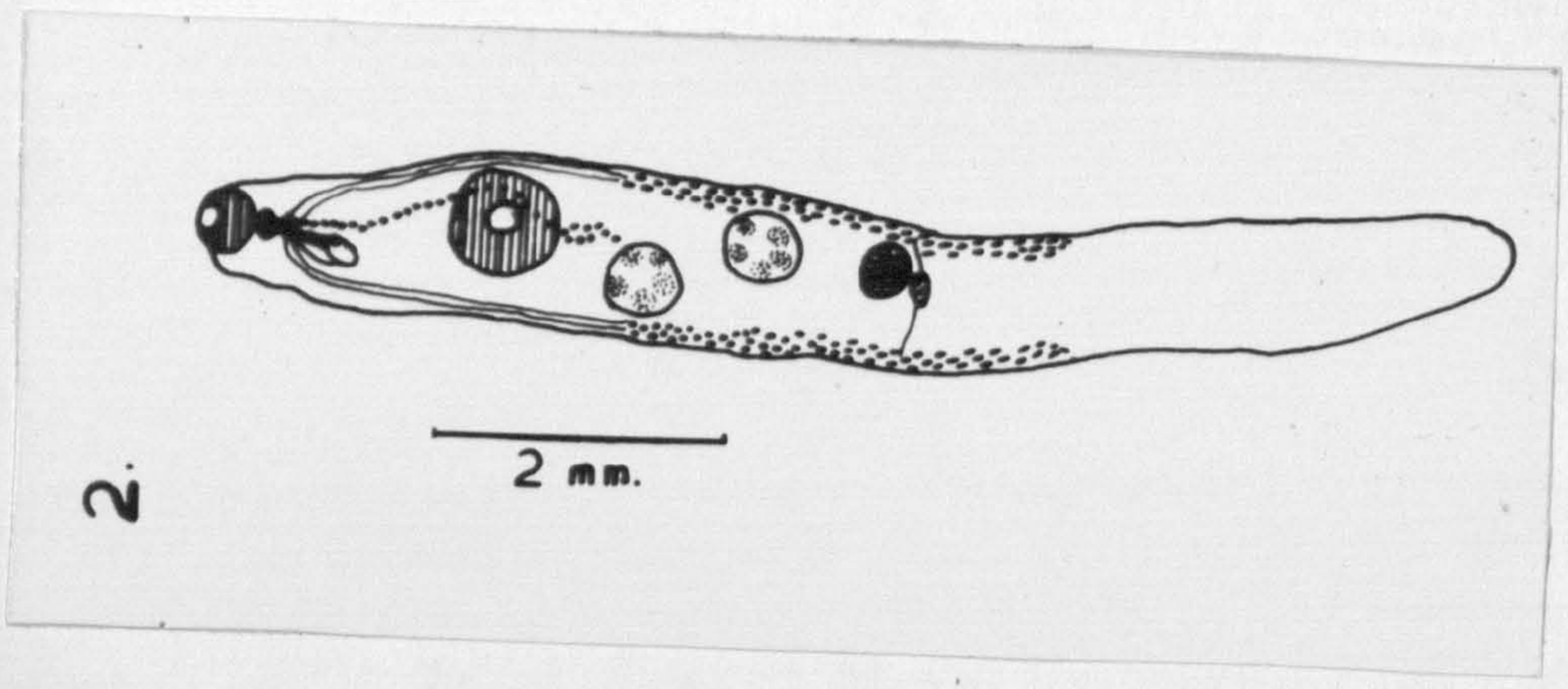
Plate 2

Lyperosomum longicauda (Rud., 1809)

Figure 2. Complete specimen


2.
2 mm.

the ventral sucker to enter the cirrus sac, which is long and flask-shaped, 0.5 mm. by 0.22 mm. The internal seminal vesicle is 0.15 mm. by 0.2 mm. and the cirrus and ductus ejaculatorius together measure 0.35 mm. The cirrus is unarmed. The genital atrium is in the midline immediately posterior to the pharynx.

e) Reproductive system - Female

The ovary is ovoid and posterior to the testes from which it is separated by coils of the uterus. It is to the left of the midline, 0.28 mm. by 0.32 mm. Behind and connected by a small oviduct is Mehlis' gland, 0.1 mm. by 0.05 mm. Ventral to Mehlis' gland is the small yolk reservoir which is 0.045 mm. in diameter. The uterus arises from the postero-dorsal margin and continues backwards to fill the posterior half of the body, before turning anteriorly to pass between the testes and the ovary and open into the genital atrium. The vitellaria are composed of small follicles (0.045 mm. in diameter) which extend as a thin strip for some 4 mm. behind the anterior testis on each side. The eggs are 0.026 mm. by 0.021 mm.

Discussion

The two most recent redescriptions are given in Table 4 for comparison. The writer suggests that Davies' description is for L. strigosum (Looss, 1899) in which the ovary is larger than the transversely ovoid testis. This latter species was recorded from the European Bee-eater (Merops apiaster (L.)) which is an occasional visitor to Britain and a local infection may have taken place.

TABLE: 4 Lyperosomum longicauda (Rud., 1809) Braun, 1902

Characters	Davies, 1958	Mettrick, 1958	Author
Length	7.6	10.1	8.0 - 10.5
Breadth	1.1	1.2	0.95 - 1.2
Oral Sucker	0.29 x 0.32	0.34 x 0.44	0.35 - 0.42
O.S. Opening	-	-	0.15
Pharynx	-	0.19 - 0.28	0.18 - 0.19
Pharynx wall thickness	-	-	0.065
Caecum width	-	-	0.035
Ventral Sucker	0.72	0.74 x 0.84	0.75 - 0.8
V.S. Opening	-	-	0.4
Distance O. - V.	-	-	1.6
Anterior testis	0.25 x 0.19	0.52 x 0.52	0.51 x 0.5
Posterior testis	0.25 x 0.19	0.55 x 0.49	0.51 x 0.48
Cirrus sac	0.45 x 0.19	0.52 x 0.23	0.5 x 0.22
Cirrus	-	-	0.35
Seminal Vesicle	-	-	0.15 x 0.2
Ovary	0.35 x 0.25	0.25 x 0.31	0.28 x 0.32
Mehlis' gland	-	-	0.1 x 0.05
Yolk follicle	-	-	0.045
Yolk extent	-	-	4 mm. from ant. testis
Egg	0.021- 0.023 x 0.023- 0.026	0.032x 0.021	0.026x 0.021

The Carrion Crow (Corvus corone corone L.) and the Magpie (Pica pica (L.)) are new hosts for Britain, while the Fieldfare (Turdus pilaris L.) is a new host record.

FAMILY: DICROCOELIIDAE Odhner, 1910

S.F.: Dicrocoeliinae Looss, 1899

Tribe: Lutztrematini Yamaguti, 1958

Genus: Lutztrema Travassos, 1941

The genus Lutztrema was erected by Travassos (1941) to include those species with an elongate body, the ventral sucker larger than the oral, which is subterminal. The oesophagus leads into a single caecum, or, alternately, rudimentary double caeca. The testes are tandem and post-acetabular, with the ovary immediately behind the posterior testis. The atrium is between the suckers, close to the pharynx, while the vitelline follicles are large, few in number, post-ovarian. He named as type, L. obliquum (Travassos, 1917) Travassos, 1941. He included L. insigne, L. marinholutzi, and L. verrucosum, (all Travassos, 1941), L. transversum (Travassos, 1917) and L. monenteron (Price & McIntosh, 1935) Travassos, 1941.

In his revision of the Family in 1944, Travassos added L. alaudae (Layman, 1926), L. attenuatum (Dujardin, 1845), L. colorosum (Patwardhan, 1935), L. donicum (Issaitschikoff, 1919), L. kakea (Bhalero, 1926), L. magnitestitium (Layman, 1922)

and L. transversogenitale (Layman, 1922). Since this date two more species have been added to the genus: L. microstomum Denton and Byrd, 1951 and L. sturni Skrjabin and Evranova, 1952.

3) Lutztrema monenteron (Price and McIntosh, 1935) Travassos, 1941. Syn. Lyperosomum monenteron Price and McIntosh, 1935.

Price and McIntosh (1935) described Lyperosomum monenteron from the bile ducts of the Robin (Erithacus rubecula melophilos Hartert) and the Blue Robin (Sialia sialis (L.)). In 1941, Travassos considered it to be synonymous with his species, L. obliquum (Travassos, 1917) on the grounds that only the caecum length and egg size differed. Ishii (1942) redescribed monenteron from the Ruffed Grouse (Bonasa umbellus (L.)) and the American Kingbird (Tyranus tyranus (L.)), again in North America. Denton and Byrd (1951) examined both Price and McIntosh's and Ishii's material and reported that the caecum terminates well before the end of the body and that the egg size is constant, but felt unable to confirm Ishii's identification. They added the Northern Mocking Bird (Mimus polyglottis (L.)) and the Brown Thrasher (Toxostoma rufum (L.)) to the host list.

The first European records were those of Mettrick (1958) in the Blackbird (Turdus merula L.), the Fieldfare (Turdus pilaris L.) and the Rook (Corvus frugilegus L.). The writer has found Lutztrema monenteron (Price and McIntosh, 1935) in three Blackbirds - five specimens, Nov. 1960, April 1961,

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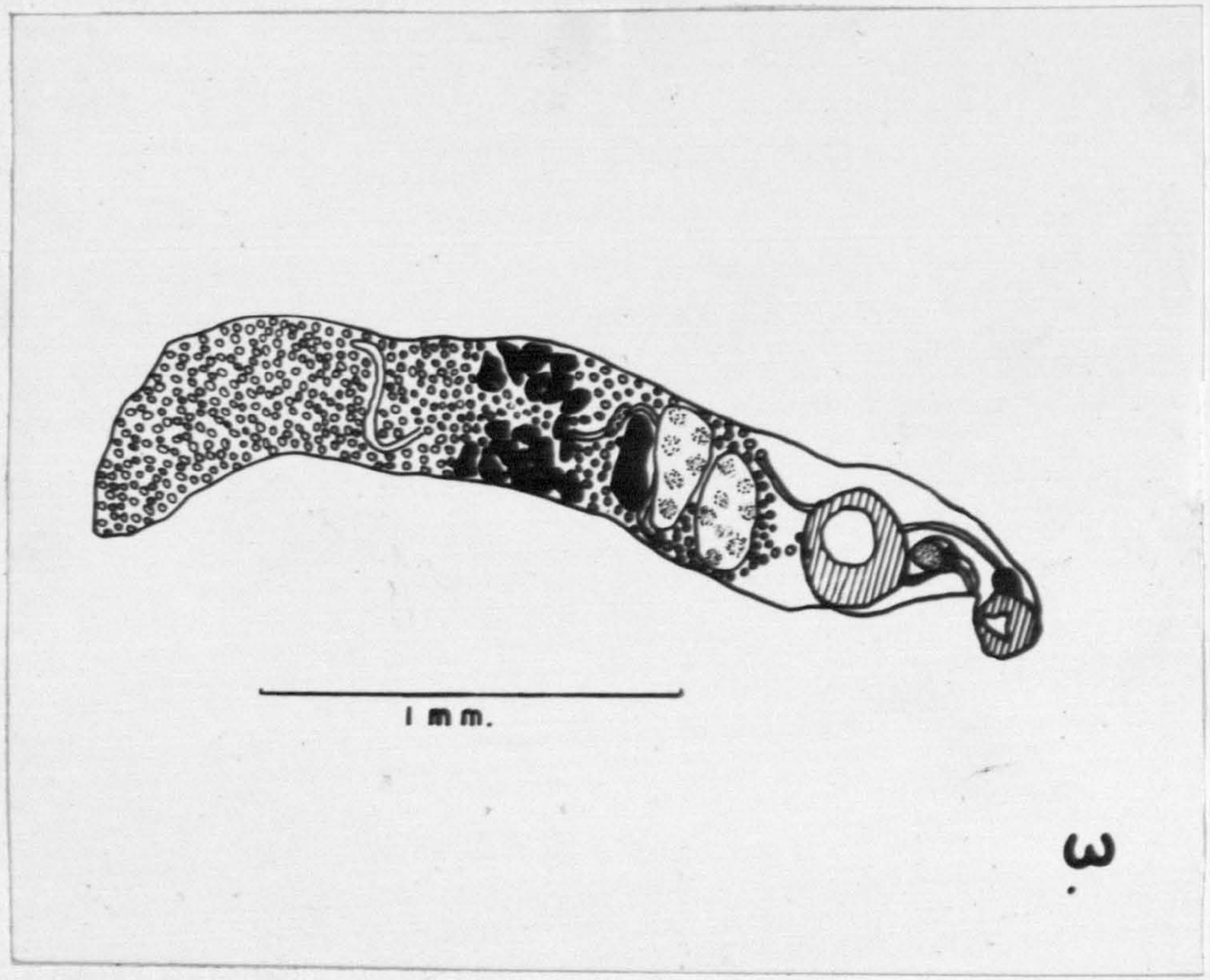
Plate 3

Lutztrema monenteron (Price & McIntosh, 1935)

Figure 3. Complete specimen.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Jan. 1962, the Robin - a single specimen, Jan. 1962, the Redwing (Turdus musicus L.) - a single specimen, March 1963, the Great Tit (Parus major L.) - two specimens, Nov. 1962, and the House Sparrow (Passer domesticus (L.)) - a single specimen, Aug. 1963. All were taken from the gall bladder.

One specimen was sectioned and seven, chosen at random, were stained and mounted.

External Morphology

The body is elongate, rounded at the posterior end and pointed anteriorly. The specimens varied from 2.48 - 4.102 mm. in length and in the testes region were 0.284 - 0.574 mm. broad. The cuticle is thin and unarmed. The oral sucker is directed ventrally and is overlapped anteriorly by a fold of the body. It is muscular, globular, with an opening of 0.065 mm. and a uniform diameter of 0.112 - 0.132 mm. At a distance of 0.284 - 0.435 mm., the ventral sucker occurs as a large muscular body (opening 0.113 mm.) which is 0.132 - 0.24 mm. long and 0.215 - 0.35 mm. broad. Both suckers are in the anterior quarter of the body.

Internal Morphology

a) Alimentary canal

The pharynx opens directly from the oral sucker and is rounded, 0.049 - 0.079 mm. in diameter. From it the oesophagus extends directly into a single caecum which is always on the dorsal side of the body. The caecum passes round the right hand side of the anterior testis and then between the posterior

testis and the ovary. It goes between the lateral vitellaria and terminates 1.61 mm. behind the ventral sucker to the right of the midline, that is two-thirds of the way between the ventral sucker and body end. Its diameter varies from 0.024 - 0.04 mm.

b) Musculature

The cuticle is 0.003 mm. thick and beneath it is found the usual arrangement of muscles. These are more concentrated between the suckers than in the rest of the body.

c) Excretory system

The vesicle could not be traced satisfactorily.

d) Reproductive system - Male

The two testes are in tandem and vary greatly in shape from triangular and flattened, (Figure 3), to perfectly round. They occupy most of the body width, the anterior testis being 0.132 - 0.24 mm. long by 0.215 - 0.35 mm. broad. The posterior testis is 0.148 - 0.29 mm. long and 0.23 - 0.374 mm. wide. Each vas efferens arises in the midline and they fuse to form the vas deferens which passes dorsal to the ventral sucker to enter the cirrus sac. The sac is pear-shaped, 0.198 - 0.212 mm. long and 0.066 - 0.115 mm. broad at its posterior end. The posterior portion is occupied by the globular internal seminal vesicle (0.115 mm. by 0.7 mm.), in front of which is a small pars prostatica region and the bulb of the ductus ejaculatorius (0.06 mm. by 0.04 mm.). The cirrus, within the cirrus sac, is up to 0.132 mm. long and although it was not seen fully everted, a partial eversion (0.05 mm. long) was 0.037 mm. in diameter at

the base. The genital atrium is on the ventral surface approximately 0.06 mm. from the pharynx. The cirrus is not spined.

e) Reproductive system - Female

The ovary lies in the midline behind the posterior testis. It is usually rounded but may be transversely flattened (Figure 3). It varies between 0.091 - 0.121 mm. long and 0.124 - 0.189 mm. broad. On the posterior dorsal side the ovicapt gives rise to the oviduct which passes backwards in a ventral direction and receives the yolk ducts before entering Mehlis' gland, which is usually round, but like the ovary and testes can be very much flattened. It is 0.043 - 0.105 mm. long and 0.082 - 0.121 mm. wide. The yolk reservoir, Laurer's canal and the receptaculum seminis were not found.

The uterus passes backwards and fills the posterior end of the body before looping forwards and crossing the ventral sucker on the dorsal side. It opens as the thick-walled metraterm (diameter 0.031 mm.) into the genital atrium posteriorly to the cirrus sac.

The vitellaria consist of two lateral groups of large, rather triangular follicles, 0.095 mm. in diameter. The groups meet in the midline anteriorly and are irregular in distribution. Of the seven mounted specimens, four had more follicles on the right hand side than on the left, and vice versa.

The mature eggs are thick-shelled and measure 0.033 mm. by 0.021 mm.

TABLE: 5 *Lutztrema monenteron* (Price & McIntosh, 1935)

Characters	Price and McIntosh, 1935	Mettrick, 1958	Author
Length	1.9 - 5.2	1.9 - 4.4	2.48 - 4.102
Breadth	0.63 - 0.67	0.27 - 0.54	0.284 - 0.574
Oral Sucker	0.12 - 0.17	0.11 - 0.15	0.112 - 0.132
O.S. Opening	"	-	0.05
Pharynx	0.042 - 0.06 X 0.05 - 0.07	0.03 - 0.08	0.049 - 0.079
Caecum width		-	0.024 - 0.04
Ventral Sucker	0.17 - 0.32 X 0.2 - 0.32	0.17 - 0.3 X 0.12 - 0.129	0.132 - 0.24 X 0.215 - 0.35
V. S. Opening		-	0.12
Distance O. - V.	$\frac{1}{5}$ th body length	0.14 - 0.5	0.284 - 0.453
Anterior testis	0.14 - 0.26 X 0.25 - 0.46	0.09 - 0.3 X 0.17 - 0.32	0.132 - 0.24 X 0.215 - 0.35
Posterior testis	" "	0.08 - 0.29 X 0.15 - 0.38	0.148 - 0.29 X 0.23 - 0.374
Cirrus sac	0.16 - 0.32 X 0.065 - 0.1	-	0.198 - 0.212 X 0.066 - 0.115
Cirrus	-	-	0.132 - 0.037
Seminal Vesicle	-	-	0.115 - 0.07
Ovary	0.09 - 0.125 X 0.1 - 0.22	0.08 - 0.14 X 0.09 - 0.23	0.091 - 0.121 X 0.124 - 0.189
Mehlis' gland	-	-	0.043 - 0.105
Yolk follicle	-	-	0.095
Eggs	0.032 x 0.016	0.032 - 0.036 X 0.016 - 0.024	0.033 - 0.036 X 0.021

Discussion

Table 5 summarises the author's measurements, together with those of Price and McIntosh (1935) and Mettrick (1958). It will be observed that there is a good degree of correspondence between the three columns.

The Robin (Erithacus rubecula melophilos Hartert) is a new host record for Britain, while the Redwing (Turdus musicus L.), the Great Tit (Parus major L.) and the House Sparrow (Passer domesticus (L.)) are new host records. The trematode has not previously been recorded from Wales.

An attempt at elucidating the life history of Lutztrema monenteron has been reported by Villela (1961).

FAMILY: DICROCOELIIDAE Odhner, 1910

S.F.: Dicrocoeliinae Looss, 1899

Tribe: Eurytrematini Yamaguti, 1958

Genus: Zoonorchis, Travassos, 1944

4) Zoonorchis petiolatum (Railliet, 1900) Denton & Byrd, 1951

Syns. Dicrocoelium petiolatum Railliet, 1900

Platynosomum petiolatum (Raillet, 1900) Looss, 1907

Lyperosomum petiolatum (Railliet, 1900) Travassos 1944

Dicrocoeliodes petiolatum (Railliet, 1900) Dollfus, 1954

Dicrocoelium petiolatum was found in the bile ducts of the Jay (Garrulus glandarius (L.)) in Europe. It was included by Looss (1907) in his new genus Platynosomum. Travassos (1944) did not incorporate it in his genus Zoonorchis but relegated it to Lyperosomum Looss, 1899. Braun (1901) had described Dicrocoelium delectans from the Palm Tanager (Thraupis palmarum (Wied.)) and noted the similarity between the two species, and it is strange that Travassos included only this second species in Zoonorchis. In 1951, Denton and Byrd reported petiolatum from various passerines in the United States and claimed that Z. delectans (Braun, 1901) Travassos, 1944 and Lyperosomum petiolatum (Railliet, 1900) were conspecific. As a result, petiolatum was transferred to Zoonorchis and Z. delectans and Platynosomum marquesi Travassos, 1922, were declared synonyms. Dollfus (1954) erected the genus Dicrocoeliodes, in which petiolatum was incorporated. Later, (1957), this investigator placed Dicrocoeliodes as a subgenus of Oswaldoia Travassos, 1919. Yamaguti (1958) merged Dicrocoeliodes and Oswaldoia into the genus Lyperosomum Looss, 1899, and supported Denton and Byrd (1951) by placing petiolatum in Zoonorchis, Travassos, 1944.

Timon-David (1960) elucidated the life-history, which involves pulmonate snails and terrestrial isopods as first and second intermediate hosts respectively. The many definitive hosts are mainly passerine birds but include one Charadriiform, the Stone Curlew (Burhinus oedicemus (L.)).

The first British record is from the Blackbird (Turdus

merula L.) Baylis, 1928. In 1939 Baylis added the Jay, the Green Woodpecker (Picus viridis L.) and the Stone Curlew. Mettrick (1958) recorded Dicrocoeliodes petiolatum from the Starling (Sturnus vulgaris L.), the Redwing (Turdus musicus L.), the Songthrush (Turdus philomelos clarkii Hartert), the Fieldfare (Turdus pilaris L.), the Rook (Corvus frugilegus L.), the Jackdaw (Corvus monedula L.), the Jay and the House Sparrow (Passer domesticus (L.)). Davies (1958) found Platynosomum petiolatum (Railliet, 1900) in the Jackdaw in Hertfordshire.

The writer has found solitary specimens in the gall-bladder of each of the following hosts: the Magpie (Pica pica (L.)) - once June 1962, the Redwing - once March 1963, the Raven (Corvus corax L.) - once March 1963, and the Carrion Crow (Corvus corone corone L.) - once Nov. 1960. All four specimens were stained and mounted.

External Morphology

The body is elongate (4.5 - 5.5 mm.) and rather pointed at both ends. Its greatest diameter is found between the ventral sucker and the testes region, (0.882 - 1.05 mm.). The oral sucker is 0.298 - 0.346 mm. long and 0.256 - 0.346 mm. wide. The ventral sucker is some 0.802 - 0.84 mm. further back, is very large, 0.504 - 0.756 mm. long and 0.602 - 0.714 mm. broad, and fills most of the body diameter at this point. The two suckers occupy the anterior half of the body, (Figure 4).

The cuticle is 0.012 mm. thick and unarmed.

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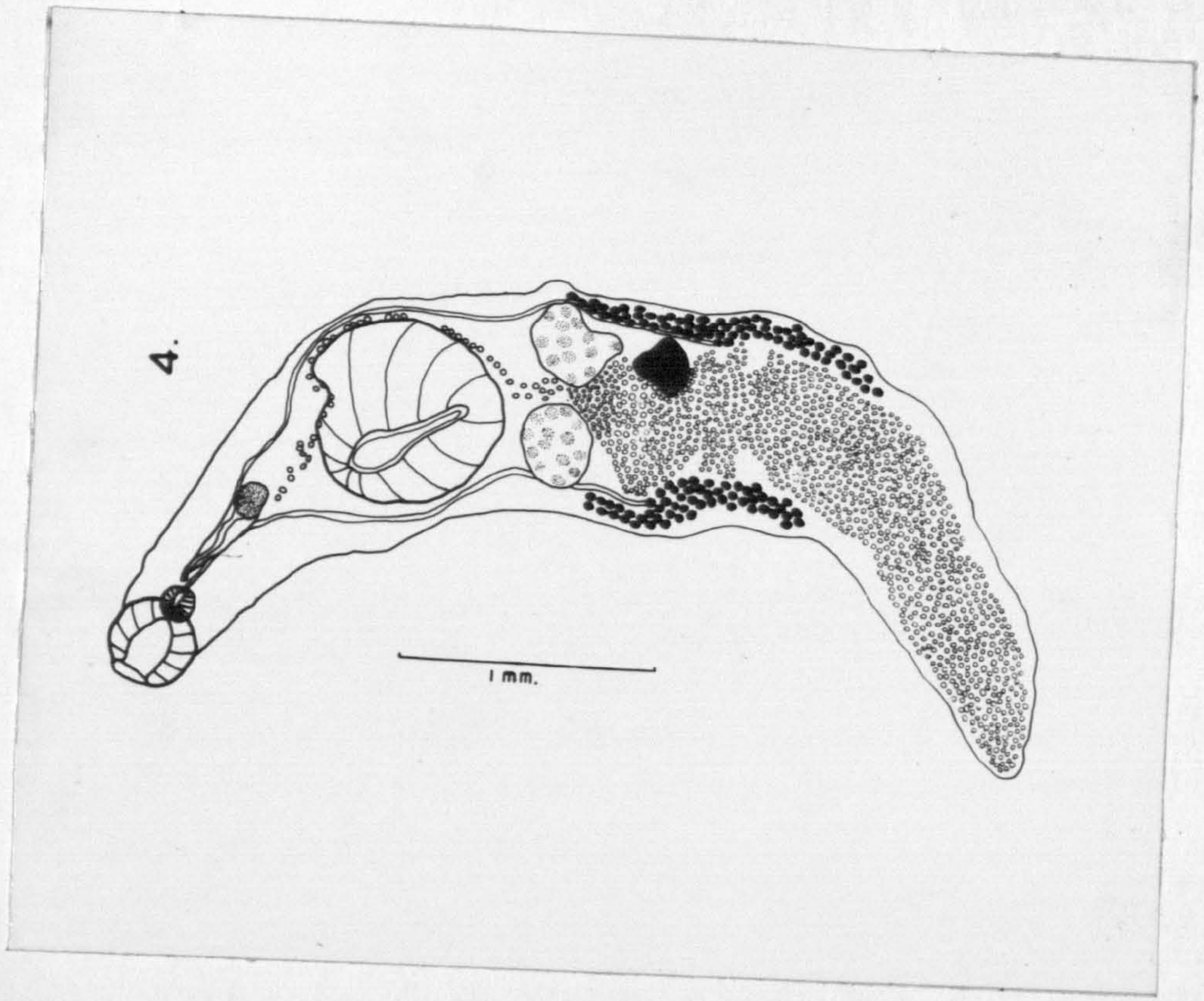
Plate 4

Zoonorchis petiolatum (Railliet, 1900)

Figure 4. Complete specimen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Internal Morphology

a) Alimentary canal

The oral sucker opens directly into the pharynx, which is round and muscular, 0.115 - 0.138 mm. in diameter, with a wall thickness of 0.063 mm. The oesophagus is short and bifurcates dorsal to the cirrus sac. Each caecum extends laterally to near the posterior tip of the body. Their average diameter is 0.04 mm.

b) Musculature

No serial sections were made.

c) Excretory system

The vesicle could not be observed in the whole mounts.

d) Reproductive system - Male

The testes are found at the same level, to the right and left of the midline, behind the ventral sucker. They are round-to-oval and measure 0.212 - 0.341 mm. long by 0.312 - 0.346 mm. wide. The vas deferens passes dorsal to the ventral sucker and enters the cirrus sac. This is found in the midline, 0.2 mm. in front of the ventral sucker, and is 0.45 - 0.49 mm. long and 0.1 - 0.113 mm. broad. It is pear-shaped, the broadest, posterior portion containing the internal seminal vesicle, which is 0.115 mm. by 0.06 mm. There is no external seminal vesicle. The cirrus is unarmed and within the cirrus sac is 0.181 mm. long and 0.03 mm. wide. It was not found extruded. The genital atrium is directly posterior to the pharynx, in the midline of the body.

e) Reproductive system - Female

The ovary is to the left of the midline, directly behind the testis on that side. It is ovoid, 0.17 mm. long and 0.198 mm. broad. To the right, in the midline, is Mehlis' gland, which did not stain well and is much obscured by the uterus so that measurements cannot be recorded. The yolk ducts, yolk reservoir, receptaculum seminis and Laurer's canal were not observed. The uterus fills the entire posterior half of the body before turning anteriorly and passing between the testes. It rises to the dorsal surface and crosses over the ventral sucker to open in the genital atrium anterior to the cirrus sac. The metraterm is 0.04 mm. in diameter.

The vitellaria are found laterally from the anterior level of the testes to the beginning of the posterior third of the body. Their extent is from 0.882 - 1.344 mm. and the average diameter for a single follicle is 0.04 mm.

The eggs are thick-shelled and vary from 0.036 - 0.41 mm. long and 0.031 - 0.033 mm. wide.

Discussion

The measurements recorded above agree very well with those of previous descriptions of petiolatum (Table 6).

The Magpie (Pica pica (L.)) is a new host record for Britain, Timon-David (1953) having recorded Z. petiolatum from this host in France. The Raven (Corvus corax L.) and the Carrion Crow (Corvus corone corone L.) are new host records.

Ther are no previous records of this species from Wales.

TABLE: 6 Zoonorchis petiolatum (Railliet, 1900)

Characters	Davies, 1958	Mettrick, 1958	Author
Length	2.0 - 2.5	4.3 - 10.2	4.5 - 5.5
Breadth	0.59 - 0.73	0.8 - 1.6	0.882 - 1.05
Oral Sucker	0.26 - 0.3 x 0.15 - 0.19	0.18 - 0.53 x 0.21 - 0.6	0.298 - 0.346 x 0.256 - 0.346
O. S. Opening	-	-	0.13
Pharynx	-	0.075 - 0.26	0.115 - 0.138
Pharynx wall thickness	-	-	0.063
Caecum width	-	-	0.04
Ventral Sucker	0.45 - 0.51	0.45 - 0.95 x 0.54 - 0.96	0.504 - 0.756 x 0.602 - 0.714
V. S. Opening	-	-	0.22
Distance O. - V.	-	-	0.802 - 0.84
Testes	-	0.11 - 0.47 x 0.14 - 0.59	0.212 - 0.341 x 0.312 - 0.346
Cirrus Sac	-	-	0.45 - 0.49 x 0.1 - 0.113
Cirrus	-	-	0.181 x 0.03
Seminal Vesicle	-	-	0.115 x 0.06
Ovary	-	0.15 - 0.38	0.17 x 0.198
Yolk follicle	-	-	0.04
Yolk extent	-	-	0.882 - 1.344
Eggs	0.03 - 0.024	0.028 - 0.052 x 0.02 - 0.028	0.036 - 0.041 x 0.031 - 0.033

FAMILY: MICROPHALLIDAE Travassos, 1920

S.F.: Gymnophallinae Odhner, 1905

Genus: Gymnophallus Odhner, 1900

The genus Gymnophallus was created by Odhner (1900) to incorporate the species which were included under the generic name Distomum and lacked a cirrus sac, the pars prostatica and the seminal vesicle lying freely in the parenchyma. Other characters (p.14) are subterminal oral sucker, the whole body covered with spines, prepharynx absent, pharynx very small, oesophagus short or absent, caecae not long, excretory vesicle very large and Y-shaped with long branches, genital pore in front of the ventral sucker in the midline, no ductus ejaculatorius, receptaculum seminis absent, Laurer's canal present, vitellaria in the midline near the ventral sucker, Mehlis' gland to the right of the ventral sucker, eggs small (0.017 - 0.027 mm.). He named as type Distomum deliciosum Olsson, 1893, and included D. micropharyngeus Lühe, 1898, D. somateriae Levinsen, 1881 and added two new species, Gymnophallus choledochus and Gymnophallus bursicola.

The genus now includes G. affinis Jameson and Nicoll, 1913, G. dapsilis Nicoll, 1909, G. macroporus Jameson and Nicoll, 1913, G. macrostoma Yamaguti, 1939 and G. ovoplenus Jameson and Nicoll, 1913.

Stunkard (1959) read a paper on the life history of Gymnophallus to the International Congress of Zoology, no.15, in London.

5) Gymnophallus deliciosus (Olsson, 1893) Odhner, 1900

Syn. Distomum deliciosum Olsson, 1893

Distomum deliciosum was described from the gall-bladder of a Herring Gull (Larus argentatus Pont.) by Olsson (1893). Odhner (1900) recorded and redescribed the species from the Herring Gull, the Lesser Black-backed Gull (Larus fuscus L.) and the Common Gull (Larus canus L.) from the West coast of Sweden. There have been numerous records of this species from Europe since this date, while British records include the Herring Gull (Nicoll, 1907; Ritchie, 1915; Davies - unpubl. 1937; Baylis, 1939; Williams, 1962; Pemberton, 1963) and the Lesser Black-backed Gull (Pemberton, 1963).

The writer has found specimens in the Herring Gull (in thirteen out of seventeen), the Common Gull (in two out of five), the Great Black-backed Gull (Larus marinus L. - in twenty-one out of thirty-three), the Lesser Black-backed Gull (in seven out of nine) and the Black-headed Gull (Larus ridibundus L. - in one out of three). The worm burden varied from two (in the Black-headed Gull) to nineteen (in the Great Black-backed Gull). The Black-headed Gull was shot in December 1961, the Common Gulls in the winter months of 1960 and 1962, while the other specimens were obtained throughout the year from all parts of Pembrokeshire and in particular from Skomer Island.

External Morphology

The trematode is elongate-oval and at its broadest across the testes, (Figure 5). The length is 0.84 - 1.598 mm. and the

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Plate 5

Gymnophallus deliciosus (Olsson, 1893)

Figure 5. Complete specimen

Gymnophallus numenii sp. nov.

Figure 6. Complete specimen

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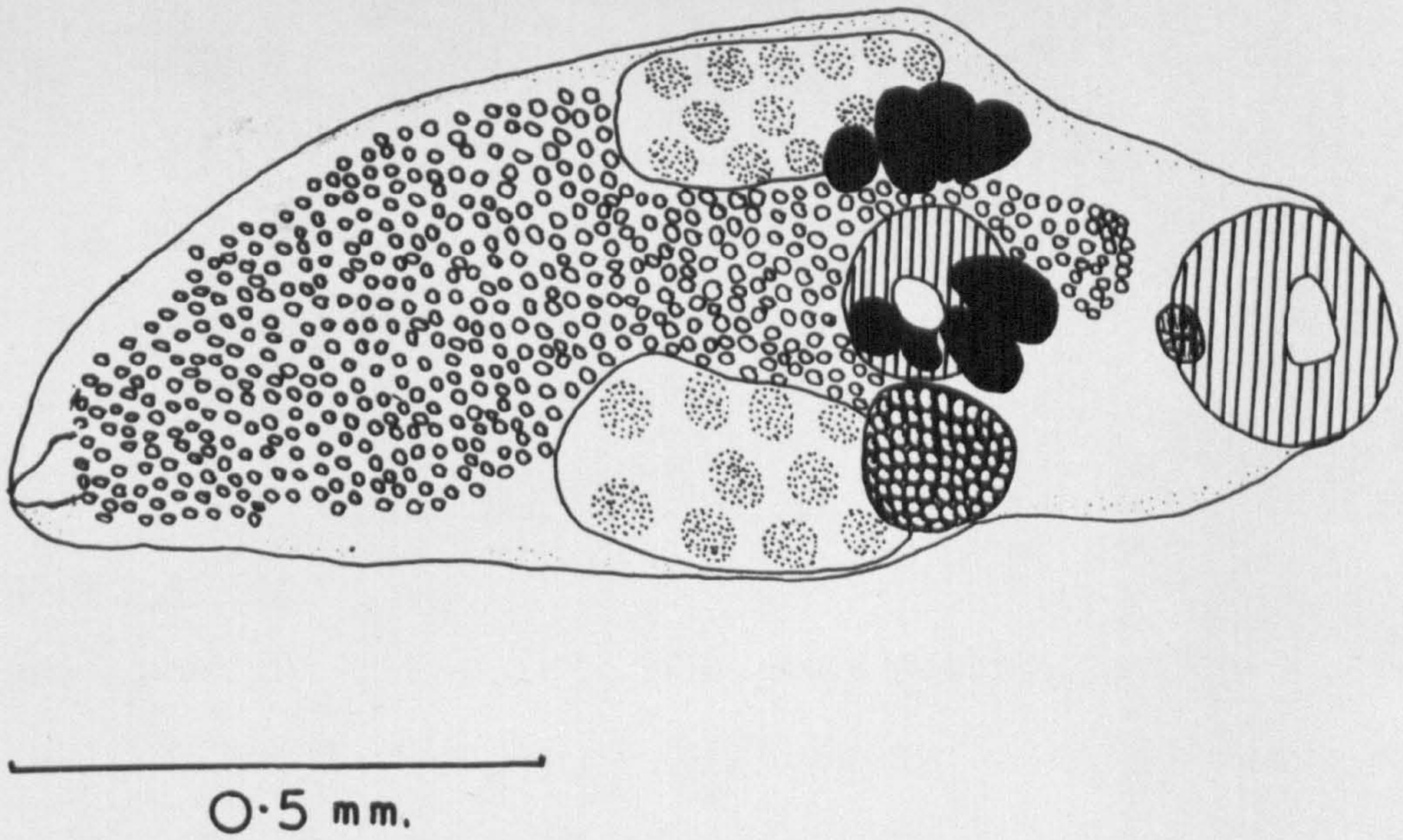

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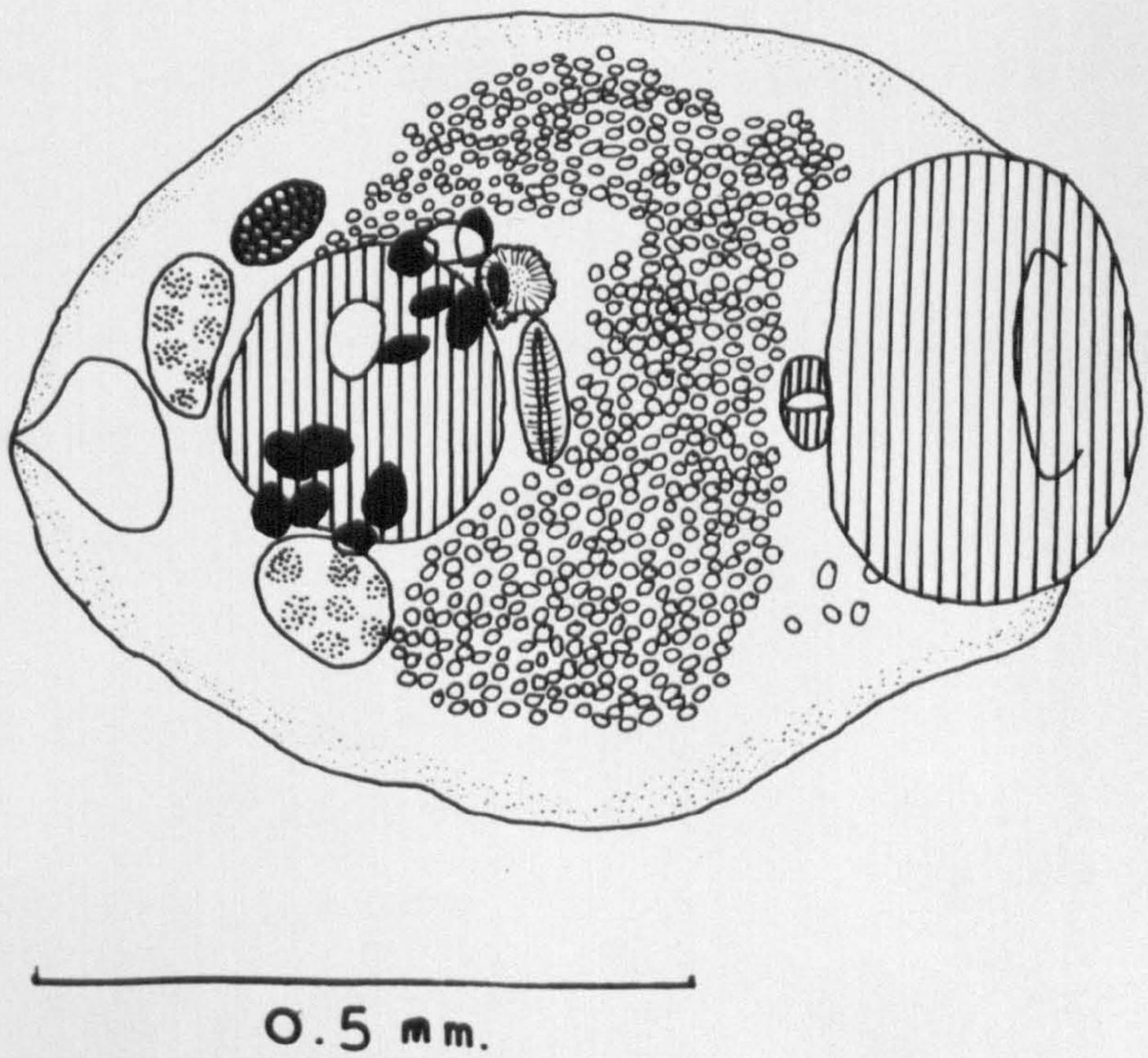

width, 0.526 - 0.98 mm. The cuticle is densely covered with small spines, 0.006 mm. long and 0.003 mm. at the base.

The oral sucker is muscular and subterminal, slightly wider than long, 0.198 - 0.24 mm. by 0.226 - 0.254 mm. The ventral sucker is in the anterior half of the body, 0.164 - 0.35 mm. from the oral sucker and is more spherical, 0.171 - 0.204 mm. by 0.187 - 0.215 mm.

Internal Morphology

a) Alimentary canal

A small pharynx opens into the oral sucker, 0.04 - 0.06 mm. in diameter. A short oesophagus bifurcates into two caeca which terminate just behind the ventral sucker in the equatorial region. Each is slightly dilated at the end.

b) Musculature

The cuticle is 0.01 mm. thick and overlies a single layer of circular muscle fibres, longitudinal muscle fibres and oblique muscle fibres.

c) Excretory system

The large Y-shaped excretory vesicle has a terminal pore and the branches of the Y reach forward to the oesophageal region on each side. The bifurcation occurs in the testes region.

d) Reproductive system - Male

The testes are in the equatorial region of the body, on each side of the ventral sucker and are variable in shape. That on the right measures 0.332 - 0.346 mm. long and 0.181 - 0.44 mm.

broad, while that on the left is 0.35 - 0.428 mm. long and 0.22 - 0.346 mm. broad. The left testis touches the ovary, or may even overlap it, on the dorsal side. The vas efferens from the left testis crosses behind the ventral sucker to fuse with that from the right testis and form the vas deferens. This latter duct continues anteriorly as the seminal vesicle which is in turn continuous with the free-lying pars prostatica complex, before entering the stout and muscular cirrus on the right-hand side of the body. The cirrus is pear-shaped, 0.141 mm. long and 0.065 mm. broad at the posterior end. The pars prostatica complex is 0.06 mm. in diameter and in many of the specimens lies beneath the posterior end of the cirrus. The seminal vesicle is approximately 0.07 mm. in diameter. The cirrus is unarmed.

e) Reproductive system - Female

The ovary lies to the right of, and on a level with, the ventral sucker. It is spherical but in some specimens may be slightly elongated owing to the proximity of the ventral sucker. This latter shape is thought to be an artifact due to the flattening of the specimens when mounting. Its diameter is 0.148 - 0.215 mm.

Mehlis' gland is ventral and posterior to the ovary and lies between the ventral sucker and the testis on that side. The uterus follows a convoluted, backward course which fills completely the posterior half of the worm, before turning anteriorly and passing the ventral sucker on the right-hand side. The metraterm opens, alongside and at a level with the cirrus, into

TABLE: 7 *Gymnophallus deliciosus* (Olsson, 1893)

Characters	Odhner, 1900	Author
Length	1.1 - 2.3	0.84 - 1.598
Breadth	0.5 - 0.75	0.526 - 0.98
Oral Sucker	0.2 - 0.25	0.198 - 0.24 x 0.226 - 0.254
Pharynx	0.06	0.04 - 0.06
Oesophagus	0.15	-
Ventral Sucker	0.16 - 0.2	0.171 - 0.204 x 0.187 - 0.215
Testes	0.23 X 0.5	0.332 - 0.428 x 0.181 - 0.44
Ovary	0.2	0.148 - 0.215
Folk follicles	0.09 - 0.12	0.1 x 0.06
Eggs	0.022 - 0.026 x 0.014	0.023 x 0.016

the genital atrium, which is in the midline in front of the ventral sucker. The vitellaria consist of two groups of five to eight large follicles in the front half of the body. They are antero-dorsal to, and may overlap, the ventral sucker. An average follicle is 0.1 mm. by 0.06 mm.

The eggs are oval, 0.023 mm. long and 0.016 mm. broad.

Discussion

This is the first redescription of Gymnophallus deliciosus (Olsson, 1893) from a British host and is, in all important features, similar to Odhner's redescription (1900), (cf.,Table 7). The writer suggests that Odhner's Figure 1 (1900, p.15) has been drawn from the dorsal surface, since the position of the ovary and the anterior course of the uterus is quite contrary to the writer's specimens.

The Black-headed Gull (Larus ridibundus L.) is a new host record, while the Common Gull (Larus canus L.) and the Great Black-backed Gull (Larus marinus L.) are new hosts for Britain.

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6) Gymnophallus numenii sp. nov.

Six specimens of a Gymnophallus spp. were found in the gall-bladder of a Curlew (Numenius arquatus L.) shot in Nov. 1960. They were all stained and mounted and four of the specimens proved to be in poor condition.

External Morphology

The trematode is oval and broadest in the equatorial region in front of the ventral sucker, (Figure 6). It is between 0.714 - 0.798 mm. long and 0.376 - 0.63 mm. broad. The subterminal oral sucker is strong and muscular and rather rectangular in appearance, 0.2 - 0.22 mm. long and 0.215 - 0.312 mm. broad. The ventral sucker is approximately 0.256 mm. behind the oral sucker in the posterior half of the body. It is round or slightly elongated, 0.165 - 0.212 mm. long and 0.198 - 0.205 mm. broad. The cuticle is very thin and covered with tiny spines (0.003 mm.) which extend beyond the ventral sucker posteriorly.

Internal Morphology

a) Alimentary canal

The small pharynx opens directly from the oral sucker and is 0.055 mm. by 0.065 - 0.07 mm. A short oesophagus (0.07 mm.) bifurcates to form a pair of short, widely separated caeca which pass to each side and terminate in front of the ventral sucker.

b) Muscular system

Serial sections were not made.

c) Excretory system

The vesicle is round and opens by a terminal pore. Its diameter is approximately 0.13 mm. and it opens anteriorly into two lateral longitudinal ducts. The vesicle is posterior to the hindmost testis.

d) Reproductive system - Male

The testes are elongate-oval, that on the left (0.079 -

0.103 mm. by 0.075 - 0.112 mm.) being at a level with the ovary and adjacent to the posterior half of the ventral sucker. The hindmost testis is on the right side, posterior to the ovary and the ventral sucker, and closer to the midline. It is rather more elongate than the anterior testis (0.072 - 0.082 mm. by 0.1 - 0.118 mm.). The vas efferens from the left-hand testis passes posterior to the ventral sucker (diameter 0.015 mm.) and joins that of the right-hand testis to form the vas deferens. This continues anteriorly to enter the seminal vesicle, which, together with the pars prostatica, lies free in the parenchyma. The vesicle is a small, oval body (0.065 mm. long) on the ventral side of the vitellaria. It continues into the single-celled pars prostatica complex, the overall diameter of which is 0.075 mm. The cirrus is a long muscular body which opens into the genital atrium a little to the left of the midline. It is 0.12 mm. long and 0.05 mm. wide. There is no evidence of spination.

d) Reproductive system - Female

The ovary is situated at a level with the posterior half of the ventral sucker, on the right side of the body. It is smooth and oval, 0.082 - 0.092 mm. by 0.039 - 0.069 mm. Mehlis' gland was not observed, the uterus arising from a point near the posterior end of the ovary and passing forwards between it and the ventral sucker on the right side of the body. In the anterior region it loops across to the left side, partially or totally obscuring the pharynx and caeca, where it undergoes

TABLE: 8 Gymnophallus numenii sp. nov.

Characters	choledochus 1900	Odhner 1905	numenii sp. nov.
Length	1.1	1.1	0.714 - 0.798
Breadth	0.6	0.9	0.376 - 0.63
Oral Sucker	0.2	0.18	0.2 - 0.22 X 0.215 - 0.312
Pharynx	-	0.06	0.055 x 0.065
Ventral Sucker	0.16	0.013	0.165 x 0.212 X 0.198 - 0.205
Right Testis	-	-	0.1 - 0.118 X 0.072 - 0.082
Left Testis	-	-	0.079 - 0.103 X 0.075 - 0.112
Ovary	0.13	rosette shaped	0.082 - 0.09 X 0.039 - 0.06
Yolk follicle	-	-	0.036
Eggs	0.028 X 0.014		0.021 - 0.026 X 0.0165

many convolutions before opening into the genital atrium. The vitellaria (approximately six follicles on each side) consist of two lateral groups dorsal to the ventral sucker. They are most frequently anterior to the midpoint of the sucker but in one specimen were in the posterior third. The yolk duct and Laurer's canal were not traced.

The eggs are small, 0.021 - 0.026 mm. by 0.0165 mm. (average length 0.024 mm.) and very numerous.

Discussion

Two species of Gymnophallus have been recorded from the gall-bladders of birds, G. deliciosus (Olsson, 1893) from the Charadriiforms, Family Laridae and G. choledochus Odhner, 1900, from the Anseriforms. This latter species is very similar in general body formation to the description in the text above. Odhner (1900) described and drew choledochus from the preparations of his friend Dr. Jägerskiöld, and expressed the wish to produce a further and more definitive description at a later date. In 1905 he again described the species but in even less detail.

Comparison of his description and measurements (Table 8) shows that the above text differs in certain features:

a) the new species is smaller, and has larger oral and ventral suckers so that the overall proportions are markedly different,
b) the ovary is smaller and not rosette-shaped (Odhner, 1905),
c) the eggs are smaller,
d) the excretory vesicle is sac-like, not Y-shaped, and does

not extend beyond the posterior testis (cf. Odhner, 1900, Fig. 3, and his characters for the genus, p.14),

e) the uterus passes forwards on the same side as the ovary, not on the left-hand side (cf. Odhner, 1900, Fig. 3). Odhner states (p.19) 'Der Uterus dürfte auf der Figur einen mehr oder weniger schematischen Verlauf haben', so one must assume that in a schematic diagram, this last feature is correct in his figure.

Pemberton (1960) recorded, but did not describe, Gymnophallus spp. from the gall-bladder of a Curlew in Hertfordshire.

The specific name 'numenii' has been derived from the generic name of the host, Numenius arquatus L. This is the first description of a gymnophallid trematode from the Charadriiform Family Charadriidae.

FAMILY: ECHINOSTOMATIDAE Loos, 1902. emend. Poche, 1926.

Syn. Echinostomidae Dietz, 1910

S.F.: Echinostomatinae Faust, 1929

for Echinostominae Looss, 1899

Genus: Echinostoma Rudolphi, 1809

Syn. Fascioletta Garrison, 1908

7) Echinostoma revolutum (Fröhlich, 1802) Looss, 1899.

Syn. Fasciola revolutum Fröhlich, 1802

Distoma echinatum Zeder, 1803

Echinostoma echinatum de Blainville, 1828

Distoma dilatatum Miram, 1844

Distomum armatum Molin, 1858

Echinostoma mendax Dietz, 1909

Echinostoma paraulum Dietz, 1909

E. revolutum var. japonicum Kurisu, 1932

Echinostoma miyagawai Ishii, 1932

The genus Echinostoma was erected by Rudolphi, 1809, for those species which possess a row of spines surrounding the head. It was not until 1899 that Looss revised the genus and included in it Fasciola revolutum Fröhlich, 1802, as the genotype. The species has been recorded from various hosts on many occasions and the life-cycle has been investigated by workers too numerous for inclusion.

The previous British records are as follows:- the Mute Swan (Cygnus olor Gmelin) Bellingham (1844), Baylis (1928); the Whooper Swan (Cygnus cygnus L.) Bellingham (1844), Lewis (1926, 1927); the Shoveller Duck (Spatula clypeata L.) Baylis (1939); the Shelduck (Tadorna tadorna L.) Jennings and Soulsby (1957); the Golden-Eye (Bucephala clangula L.) Bellingham (1844); the Wigeon (Anas penelope L) Bellingham (1844); the Tufted Duck (Aythya fuligula (L.)) Jennings and Soulsby (1953); the Bean Goose (Anser fabalis Latham) and the Great Crested Grebe

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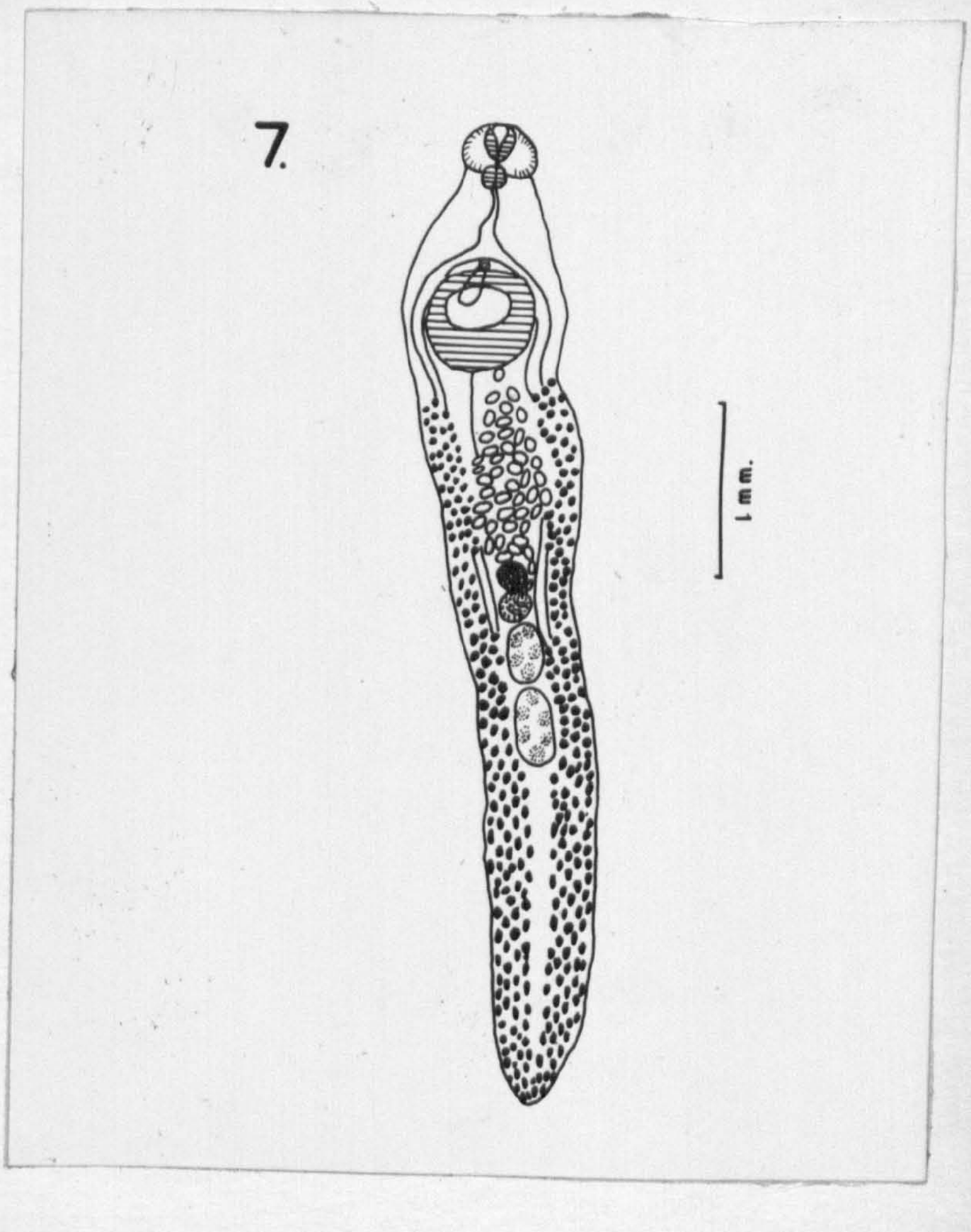
Plate 6

Echinostomum revolutum (Fröhlich, 1802)

Figure 7. Complete specimen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(Podiceps cristatus (L.)) Bellingham (1844); the Partridge (Perdix perdix L.) Clapham (1938) and the Black-headed Gull (Larus ridibundus L.) Pemberton (1963).

The writer has found the trematode on two occasions, a single specimen in the Carrion Crow (Corvus corone corone L.) - March, 1963, and two specimens in the Jackdaw (Corvus monedula L.) - August, 1963.

External Morphology

The elongate body is 5 - 6 mm. long and 0.9 - 1.05 mm. wide in the region of the ventral sucker, (Figure 7). The head is surrounded by a collar which is incomplete on the ventral side. It is 0.38 mm. in diameter and bears a crown of thirty-seven peg-shaped spines, of which twenty-seven are in a single row and the remaining spines are found in two groups of five on the ventral side, adjacent to the pharynx, (Figure 8). The dorsal spines are distinctly alternated and this has caused some workers to describe two alternate rows. Careful examination reveals that the dorsal row is unbroken, although irregular in composition. The dorsal and lateral spines are 0.085 mm. by 0.0185 mm. at the base, while the five corner spines show a distinct gradation, the smallest, innermost spines being 0.05 mm. by 0.016 mm. and the largest, outermost spines being 0.073 mm. by 0.017 mm.

The oral sucker is funnel-shaped, 0.215 mm. long and 0.181 mm. wide, with an opening of 0.07 mm., and at a distance of 0.644 mm. is the large muscular ventral sucker, 0.56 mm. by

0.616 mm. The opening of the ventral sucker is 0.374 mm. The thick cuticle, 0.02 mm. is unarmed.

Internal Morphology

a) Alimentary canal

A very short prepharynx, 0.04 mm., leads from the oral sucker into the prominent muscular pharynx, 0.165 mm. by 0.132 mm. The pharynx wall thickness is 0.067 mm. The oesophagus is 0.32 mm. long and bifurcates to form two large caeca (diameter 0.07 mm.) which continue to the posterior tip of the body.

b) Musculature

Serial sections were not made, the three specimens obtained being stained and mounted for identification purposes.

c) Excretory system

The vesicle, which is greatly elongated and Y-shaped, has a terminal pore.

d) Reproductive system - Male

The testes are in tandem in the second third of the body. The anterior testis is 0.366 mm. long and 0.212 mm. wide, and touching it is the larger posterior testis, 0.476 mm. long and 0.22 mm. wide. The vas efferens from each testis passes laterally on each side before combining with its fellow in the ventral sucker region to form the vas deferens. This latter duct enters the cirrus sac, which is an oval body overlapping the anterior third of the ventral sucker on the dorsal side. The cirrus sac is 0.31 mm. long and 0.156 mm. wide. Over half its length is occupied by the near-spherical seminal vesicle, 0.165 mm. by

TABLE 9: Echinostoma revolutum (Fröhlich, 1802) Looss, 1899

Characters	Dietz, 1909	Author
Length	6.0 - 9.0	5.0 - 6.0
Breadth	0.41 - 0.58	0.9 - 1.05
Head diameter	-	0.38
Spines	37 (27 - 5 - 5)	37 (27 - 5 - 5)
" dorsal	0.72 - 0.014	0.85 x 0.018
" corner	0.067 - 0.084 x 0.019 - 0.021	0.05 - 0.073 x 0.016 - 0.017
Oral sucker	0.18 - 0.21	0.215 x 0.181
" " opening	0.068 - 0.108	0.07
Prepharynx	0.068 - 0.102	0.04
Pharynx	0.17 - 0.18	0.165 - 0.132
Oesophagus	0.51 - 0.58	0.32
Caecum width	-	0.07
Ventral sucker	0.65 - 0.6	0.56 - 0.616
" " opening	0.34 - 0.43	0.374
Distance O. - V.	-	0.644
Anterior testis	0.43 x 0.35	0.366 x 0.212
Posterior testis	" "	0.476 x 0.22
Cirrus sac	-	0.31 x 0.156
Cirrus	-	0.145
Seminal Vesicle	-	0.165 x 0.15
Ovary	0.31 - 0.34	0.206 x 0.168
Mehlis' gland	-	0.212 x 0.256
Yolk follicle	-	0.08
Eggs	0.096 - 0.1 x	0.112 x 0.065

0.15 mm. The cirrus is 0.145 mm. long and unarmed. The genital atrium is in the midline, posterior and adjacent to the intestinal bifurcation.

e) Reproductive system - Female

The comparatively small ovary is in the midline, 0.135 mm. in front of the anterior testis. It is 0.206 mm. long and 0.168 mm. wide, and behind it is the large, well developed Mehlis' gland, 0.212 mm. by 0.256 mm. Laurer's canal, the receptaculum seminis and the yolk reservoir were not observed.

The uterus arises from the posterior end of Mehlis' gland and turns anteriorly past the ovary on the left-hand side. It fills the space between the ovary and the ventral sucker with transverse loops and passes dorsally to the ventral sucker to open into the genital atrium. The metraterm is 0.036 mm. wide, with thick walls, 0.008 mm.

The vitellaria extend from behind the ventral sucker to the posterior of the body. The average diameter of the follicles is 0.08 mm.

The large eggs are 0.112 mm. by 0.065 mm.

Discussion

The measurements in this text are smaller (except for egg size) than is usual in the text-book account of the species. They are close to Dietz' account for E. mendax Dietz 1909, an acknowledged synonym, and it is Dietz' measurements that are set out for comparison in Table 9.

This is the first redescription of the species from material

found in Britain. The Carrion Crow (Corvus corone corone L.) and the Jackdaw (Corvus monedula L.) are new host records for Britain.

FAMILY: ECHINOSTOMATIDAE Looss, 1902, emend. Poche, 1926

S.F.: Himasthlinae Odhner, 1910

Genus: Himasthla Dietz, 1909 (b), emend. Odhner, 1910.

The genus Himasthla was erected by Dietz (1909 b) and included six species: rhigedana Dietz, 1909, alincia Dietz, 1909, militaris (Rud., 1802), leptosoma (Creplin, 1829), elongata (Mehlis, 1831) and secunda (Nicoll, 1906). The following year, Odhner (1910) modified the genus to include only those species with twenty-nine to thirty-one head spines.

8) Himasthla rhigedana Dietz, 1909, is the type species and was obtained from the Curlew (Numenius arquatus (L.)) and (?) Numenius arabicus Mathews from Arabia. The only redescription is that of Prudhoe (1944) who recorded the species in five Whimbrels(Numenius phaeopus (L.)) and two Crab Plover (Dromas ardeola(?)) in Ceylon. Prudhoe's account is very brief, mentioning only the variable length and number of head spines (34 - 38), and is in agreement with Dietz' original description, but stating that the eggs are larger, 0.095 - 0.11 mm. by 0.065 - 0.077 mm. A second species, H. mcintoshi, Stunkard, 1960, which the writer considers to be a synonym,

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Plate 7

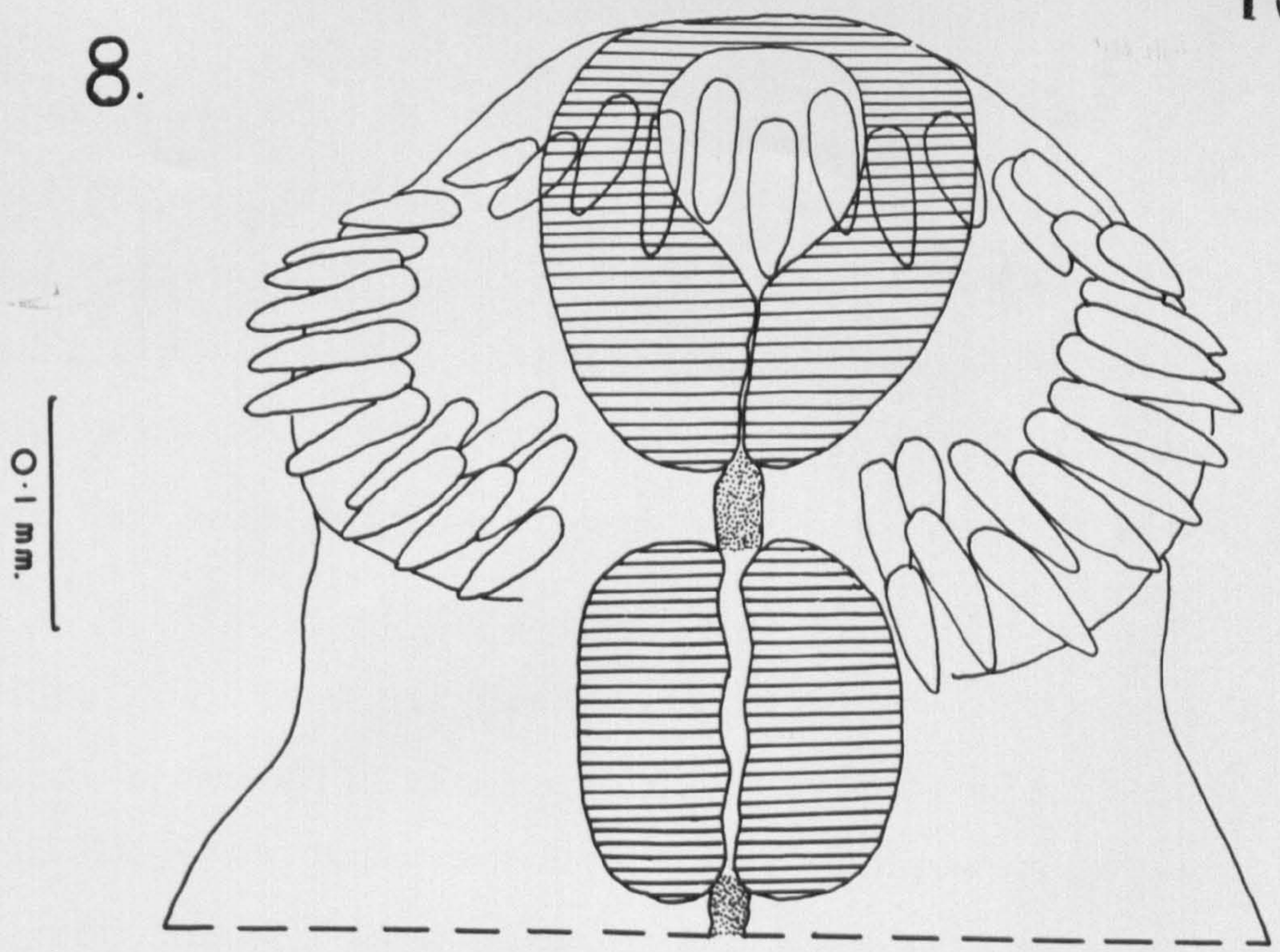
Echinostomum revolutum (Frohlich, 1802)

Figure 8. Head with spines.

Himasthla rhigedana Dietz, 1909

Figure 10. Head with spines.

8.



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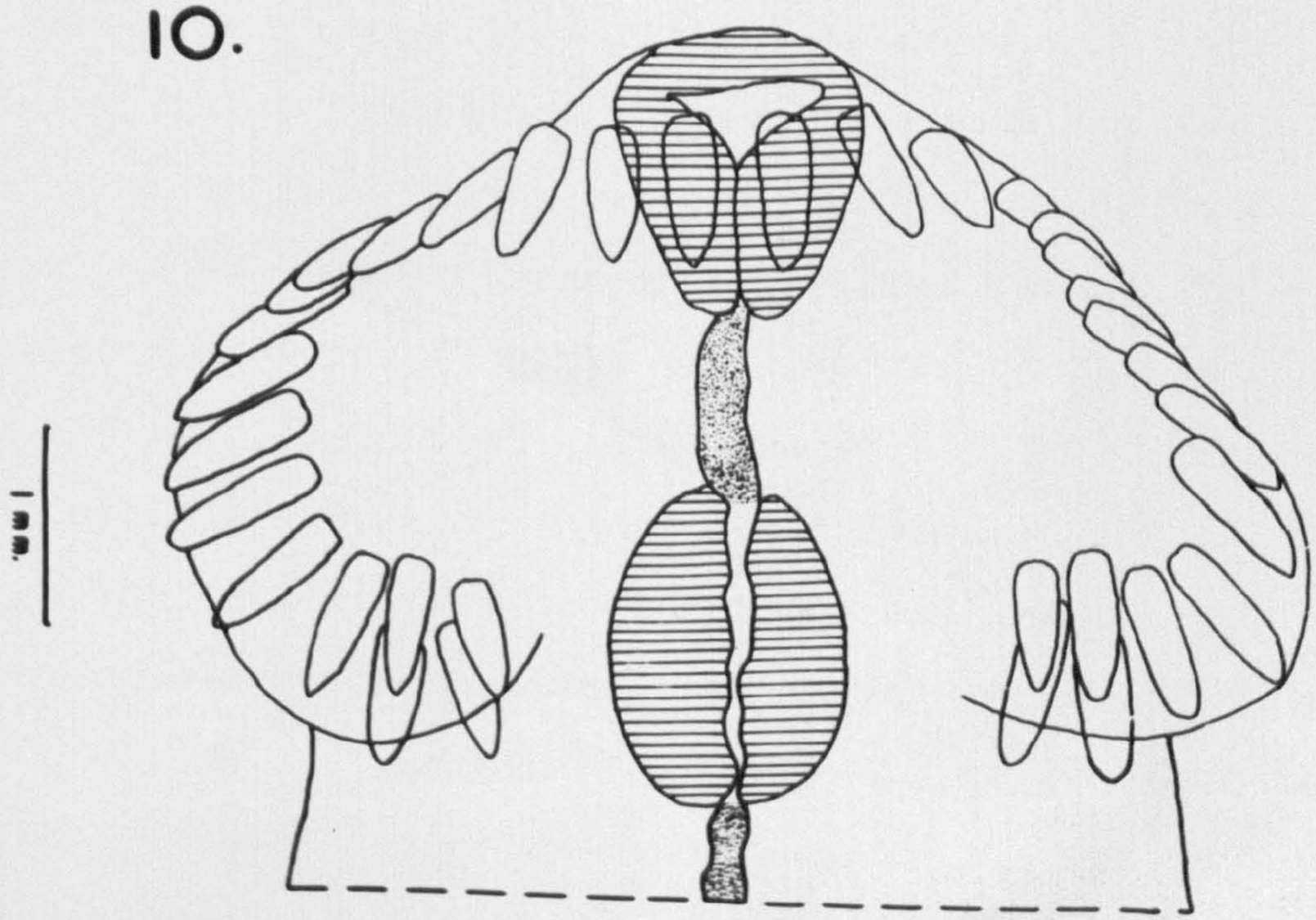

is discussed more fully below.

The writer has obtained thirty-seven specimens from six out of nine Curlews shot in Dec. 1960 (one bird), Jan. 1961 (two birds), and Nov. 1962 (three birds). A single Whimbrel was shot in Dec. 1962 and contained three further specimens.

Two of the specimens recovered were sectioned transversely.

External Morphology

The long dullish white trematode is found throughout the small intestine and at first sight closely resembles a nematode (Figure 9). Careful observation of the living worm reveals the characteristic looping movements of the body between the oral and the ventral sucker, with the corresponding dragging of the hind-body. The length of the mature specimen varies: 11.8 mm. - 13.1 mm.

The head is surrounded by a fleshy collar on which are found the head spines typical of the family Echinostomatidae. The collar is incomplete on the ventral side and emphasizes the inverted 'heart-shape' of the anterior end. There are thirty-four spines of which thirty are 'perimeter' spines (0.055 - 0.063 mm. long, 0.015 - 0.02 mm. at the base), while two pairs of slightly smaller spines - the 'corner' spines - are found on the ventral termination of the collar at each side, and are overlapped by the terminal 'perimeter' spine (0.055 mm. by 0.012 - 0.013 mm.). The spines are peg-shaped and are larger on the dorsal surface than on the lateral, (Figure 10).

Immediately behind the collar, the body spines are found

in compact rows in which the spination is parallel. The spine is backwardly directed, hook-like and scarcely protrudes from the thick cuticle in which it is embedded. It is 0.013 mm. long with a diameter of 0.005 mm. at the base. The distance between the individual spines in the pre-acetabular region is 0.006 mm. while the parallel rows of spines are 0.007 mm. apart. At a distance of 0.3 mm. behind the ventral sucker, the distance between the individual spines remains the same but the parallel rows are 0.017 mm. apart. In the ovarian region the rows attain a maximum separation of 0.078 mm., while the individual spines are 0.01 mm. apart. Spination ceases in the region around the posterior testis. The size of the individual spine remains constant throughout the body.

The head itself has a diameter of 0.226 - 0.346 mm. and there is a distinct constriction behind the collar to a diameter of 0.198 - 0.284 mm. The oral sucker is slightly subterminal. It is funnel-shaped with a length of 0.1 - 0.138 mm. and a breadth of 0.082 - 0.07 mm. The opening of the sucker varies from 0.075 - 0.1 mm. The ventral sucker, which is 0.249 - 0.312 mm. deep and 0.18 - 0.291 mm. wide is situated some 0.6 - 0.77 mm. from the oral sucker, that is approximately $\frac{1}{20}$ th. of the body length away. Its volume is five times that of the oral sucker. The opening is 0.132 - 0.24 mm. across.

The body width in the region of the ventral sucker is 0.34 - 0.49 mm., while the greatest diameter is usually to be found in the mid-body at the point of the expansion of the gravid

uterus (up to 0.56 mm.). Invariably the body tapers beyond this point, terminating bluntly. The maximum diameter across the testes is 0.412 mm.

Internal Morphology

a) Alimentary canal

A short pre-pharynx (0.055 mm.) leads from the oral sucker into the ovoid, muscular pharynx (length 0.1 - 0.13 mm., diameter 0.07 - 0.09 mm.), the walls of which are 0.028 - 0.035 mm. thick. The oesophagus continues for 0.27 - 0.42 mm. before bifurcating immediately prior to the ventral sucker. The lateral caeca are 0.036 mm. wide and terminate 0.25 mm. from the posterior tip of the body.

b) Musculature

Sectioning reveals that the cuticle consists of a thin hyaline layer and a thicker striated layer (0.011 mm.) supported by a basement membrane. The body wall muscles are arranged as is usual - outer circular muscle fibres (one layer), inner longitudinal muscle fibres (two layers) and inmost oblique muscle fibres (one layer). These fibres are found in greatest concentration between the oral and ventral suckers, where they are responsible for the looping movement resulting in locomotion, mentioned above. Below the oblique muscles is a layer of deeply staining subcuticular cells.

c) Excretory system

The irregularly-shaped bladder opens subterminally at a point about 0.04 mm. from the posterior tip on the ventral side.

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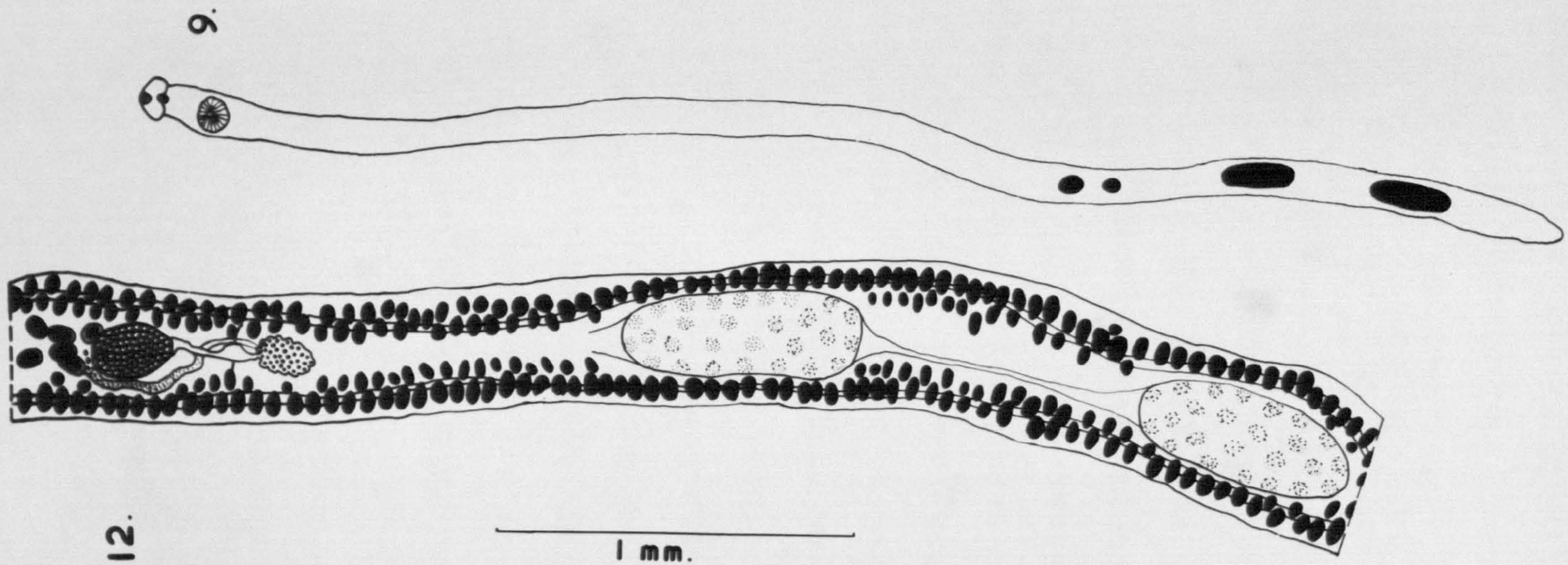
Plate 8

Himasthla rhigedana (Dietz, 1909)

Figure 9. Complete specimen. Diagrammatic.

Figure 12. Posterior end.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1 mm.

It continues forwards to a point near the posterior end of the hindmost testis, the greatest distance measured being 1.19 mm. long. There are two main longitudinal ducts which open at its anterior end and several smaller, lateral ducts have also been observed in the living specimens.

d) Reproductive system - Male

The two elongate testes are found in tandem in the posterior quarter of the body, (Figure 9). They are much longer than those of the other species of Himasthla recovered. The anterior testis measures 0.63 - 0.77 mm. long and 0.145 - 0.187 mm. broad, while the posterior testis measures 0.645 - 0.812 mm. long and 0.215 - 0.3 mm. broad. In all but three of the twenty specimens stained and mounted, the distance between the testes is equal to the length of the testes themselves and in many cases exceeds this length, (Figure 12). In only one specimen were the testes nearly touching. The post-testicular portion of this last worm had been broken and this anomaly is thought to be due to the pressure of mounting the incomplete helminth. The distance from the hindmost testis to the end of the body varies from 0.6 - 1.123 mm. In most specimens this length is far greater than that of the posterior testis. The vas efferens from each testis runs forward laterally to unite just prior to the cirrus sac. This short vas deferens expands within the body of the cirrus sac to form the voluminous internal seminal vesicle. In a cirrus sac measuring 1.126 mm. by 0.148 mm., the seminal vesicle extends for 0.7 mm., that is for more than half the length of

the total structure, (Figure 11). The broadest part of the cirrus sac is found at the posterior end in the region of the seminal vesicle. There is no external seminal vesicle. The thin-walled seminal vesicle was found, after sectioning, to consist of scattered longitudinal and circular muscles supported by a basement membrane.

A constriction separates the anterior part of the cirrus sac, which has a distinct spiral to the right. Beyond this constriction the club-shaped pars prostatica cells open into a narrow tube through tiny pores. The duct is continuous with the ductus ejaculatorius, which is a thick-walled tube, itself continuous with the cirrus but somewhat muscular and dilated at the proximal end. The cirrus is a muscular tube and can be everted for up to 0.38 mm. There are no spines.

e) Reproductive system - Female

The ovary is oval and situated in the midline at a considerable distance from the anterior testis. This distance is at least the testis length and in one specimen is actually 1.368 mm. (Figure 12). The ovary is 0.192 - 0.204 mm. in diameter with a length of 0.145 - 0.154 mm. The mature Bocytes in the cone-shaped ovicapt measure 0.01 mm. The oviduct arises from the postero-dorsal margin and turns posteriorly towards the dorsal surface where it receives first Laurer's canal and later, the median yolk duct. It has a diameter of 0.025 mm. and the walls are comprised of the usual outer longitudinal and inner circular muscles upon a basement membrane. Laurer's canal opens in the

TABLE: 10 Himasthla rhigedana Dietz, 1909

Characters	Dietz, 1909	McIntoshi Stunkard, 1960	Author
Length	9.0 - 37.5	6.0 - 11.0	11.8 - 13.1
Diameter head	0.36 - 0.42	-	0.226 - 0.346
" behind head	0.3 - 0.38	-	0.198 - 0.284
" across V.S.	0.5 - 0.57	-	0.34 - 0.49
" uterus	0.36 - 0.64	0.5 - 0.7	0.34 - 0.56
" testes	0.73 - 1.04	-	0.414
Head Spines	34 - 38 (2-3-4)	35 (29-3-3)	34 (30-2-2)
"Perimeter"	0.06 - 0.08 X 0.016 - 0.021	0.078 - 0.084 X 0.02	0.055 - 0.063 X 0.015 - 0.02
"Corner"	0.057 - 0.082 X 0.012 - 0.024	0.055 x 0.016	0.055 x 0.013
Body Spines			
Between O.S.- V.S.	0.007 - 0.019	-	0.013 x 0.005
Ovarian region	0.014 - 0.024 X 0.002 - 0.006	-	0.013 x 0.005
Distance between rows	0.061	-	0.078
Extent	-	-	Head to posterior testis
Oral Sucker	0.1 - 0.115	0.13 - 0.16	0.1 - 0.138
" " opening	0.034 - 0.068	-	0.075 - 0.1
Prepharynx	0.02 - 0.04	-	0.055
Pharynx	0.13 - 0.015	0.14 x 0.1	0.95 - 0.1
" wall thickness	0.05 - 0.06	-	0.028 - 0.035
Oesophagus	0.23 - 0.46	-	0.27 - 0.42
Caecum width	0.05 - 0.56	-	0.036
Distance from body end	0.05 - 0.128	-	0.250
Ventral Sucker	0.29 - 0.38	0.33 - 0.39 X 0.31 - 0.35	0.249 - 0.312 X 0.18 - 0.29
" " opening	0.15 - 0.23	-	0.132
Distance O. - V.	-	-	0.56 - 0.77
Anterior testis	0.72 - 1.71 X 0.32 - 0.46	-	0.63 - 0.77 X 0.148 - 0.187
Posterior testis	0.88 - 1.87 X 0.32 - 0.46	0.56 - 0.65 X 0.22 - 0.28	0.654 - 0.812 X 0.215 - 0.3
Distance between	0.67 - 1.3	-	0.374 - 0.82
Distance from body end	-	-	0.6 - 1.234
Cirrus sac	0.7 - 0.83 X 0.1 - 0.15	-	1.02 - 1.126 X 0.15 - 0.22
Cirrus	-	-	0.38
Seminal vesicle	-	-	0.7
Ovary	0.2 - 0.47	0.18 - 0.2	0.192 - 0.204 X 0.145 - 0.154
Distance from testis	0.78 - 2.08	-	0.681 - 1.368
Mehlis' gland	-	-	0.142
Yolk follicle	-	-	0.075
Eggs	0.074 - 0.81 X 0.054 - 0.061	0.1 x 0.076	0.096 - 0.105 X 0.053 - 0.069

midline, slightly anterior to the ovary.

At the junction of the oviduct and the yolk duct is Mehlis' gland (0.142 mm. diameter) which constitutes an oval central chamber surrounded by large club-shaped cells. From this central chamber, with its conglomeration of spermatocytes, ŏocytes and yolk globules, the uterus emerges on the ventral side and runs forward past the ovary to form a much convoluted mass which straightens out on the right side of the cirrus sac. As it passes over the ventral sucker, a distinct thickening of the wall indicates the metraterm which is mainly cuticular in structure with very few muscle fibres.

The lateral yolk glands are well-developed bodies, predominately oval, with a diameter of 0.075 mm. The range extends from 0.09 - 0.2 mm. from the posterior tip of the body to at least the commencement of the cirrus sac and in several cases one or both sides may overlap the cirrus sac by 0.1 - 0.25 mm. The ducts from each follicle combine and open into lateral yolk ducts which are found ventral to the caecae on each side. A transverse duct posterior to Mehlis' gland, expands to form a large oval yolk reservoir. There is no receptaculum seminis. The genital atrium is a shallow groove, 0.05 mm. in front of the ventral sucker.

The eggs are oval and measure 0.096 - 0.105 mm. long and 0.053 - 0.069 mm. wide, (Figure 19 b).

Discussion

In Table 10 are set out the measurements of Dietz (1910)

and the writer (columns 1 & 3). It is self-evident that many of the larger measurements given by Dietz are due to the enormous length of some of his specimens (9 - 37.5 mm.) so that the greater proportions, testes, ovary, suckers, etc., do not present an anomaly. The writer's specimens differ in certain features:

a) the head spines do not show the variation in numbers recorded by Dietz (1910) and Prudhoe (1944),
b) the head spines are smaller,
c) the body spines are of uniform length throughout their range,
d) the yolk glands extend for a greater distance, frequently overlapping the cirrus sac to within 0.45 mm. of the ventral sucker,
e) the eggs are larger but within the range recorded by Prudhoe,
f) the cirrus sac is larger, which is surprising in the smaller specimens.

A consideration of the sum of the features in both accounts makes it evident that the writer's specimens are rhigedana.

While neither the Curlew nor the Whimbrel are new host records, this is the first record of the species in Europe and the first record outside Arabia and Ceylon.

Table 10, column 2, sets out the measurements for H. mcintoshi Stunkard, 1960, which was recovered from the Long-billed Curlew (Numenius arquatus americana (?)) in North America. Stunkard, in his conclusions, gave the following reasons for creating his new species:

a) the two species, rhigedana and mcintoshi differ in geographic

distribution, rhigedana being from Arabia and mcintoshi from the United States. The writer suggests that this is quite unsatisfactory, if only beeause the extensive migration displayed by the Numenius spp. as a whole makes the overlap of host range and parasite burden inevitable. While the writer has recorded the first occurrence of H. rhigedana in Europe, it is idle to pretend that this parasite will not subsequently be recorded throughout the host's range, which for the Curlew (Numenius arquatus (L.)) is Northern Scandinavia to France and Russia (breeding season) and Western Asia and South Africa (wintering range). Since Stunkard's host is only a sub-species, host specificity is automatically eliminated.

b) after stating that the suckers do not differ in size, Stunkard emphasizes that rhigedana of Dietz is more than twice as large and the reproductive organs are much larger. A comparison of Table 10, columns 2 and 3, reveals that H. mcintoshi is very close in size and organ measurements to the rhigedana specimens of the writer who also has smaller measurements than Dietz.

c) he stresses that the eggs of mcintoshi are larger than those of rhigedana. It is a curious oversight on Stunkard's part that, while referring to Prudhoe's paper (1944) earlier in his text in connection with another species, he omits to mention Prudhoe's egg measurements for rhigedana. In actual fact, Stunkard's egg sizes for mcintoshi are smaller than the maximum size stated by both Prudhoe and the writer for rhigedana.

d) his main criterion is the continuation of the yolk follicles

in the testes region as opposed to the interruption at this level in rhigedana. Stunkard states that his trematodes were not fully mature, since the terminal portion of the uterus is almost empty. Most of the immature specimens found by this writer do not show a break or thinning out of the yolk in the testes region, this being in evidence only in the fully mature and elongated specimens Since Stunkard's specimens were neither fully mature nor as long as those of the writer, one must assume that this criterion is of a transitory character, prior to the elongation of the body and filling-out of the testes.

If the yolk follicle extent and arrangement is of importance in the genus, then the writer's specimens in which the yolk glands extend to the cirrus sac and beyond, show as great an anomaly as that demonstrated by Stunkard. In fact, Stunkard's species agrees well with rhigedana of Dietz in that the yolk follicles stop short of the cirrus sac.

A reading of Stunkard's text reveals a different arrangement of the head spines and he suggests, with reference to Dietz' account, that the contraction of the collar tends to obscure the disposition. That the number and arrangement of the head spines does vary is confirmed by Prudhoe (1944) so that the arrangement as given by Stunkard by no means supports the creation of a new species. The variable length of the head spines can be seen by comparing the three columns.

In view of the foregoing criticism of Stunkard's criteria for differentiating mcintoshi from rhigedana, the writer suggests that mcintoshi be considered a synonym.

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Plate 9

Himasthla rhigedana Dietz, 1909

Figure 11. Head with cirrus sac. L.P. X 10

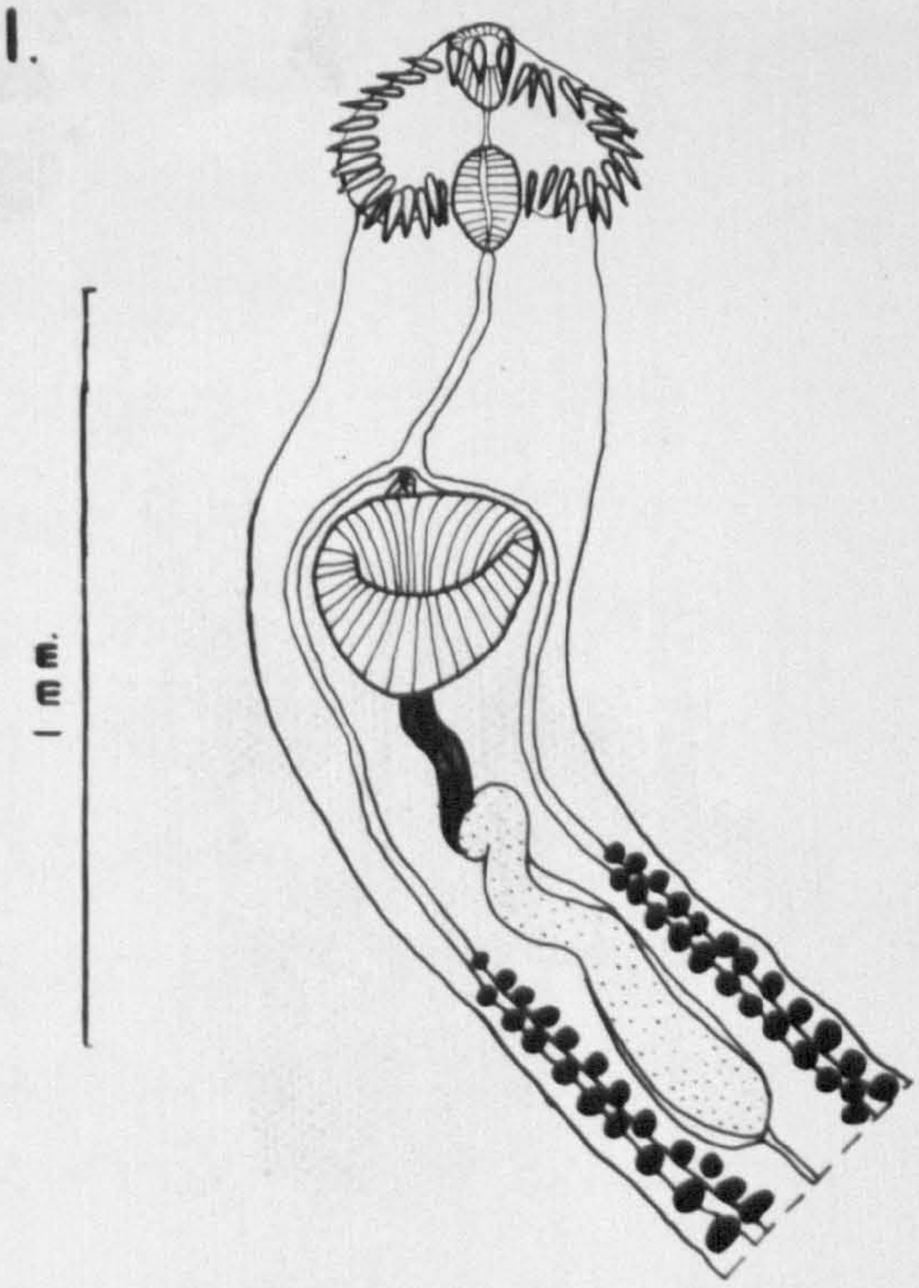
Himasthla leptosoma (Creplin, 1829)

Figure 13a. Complete specimen. Diagrammatic.

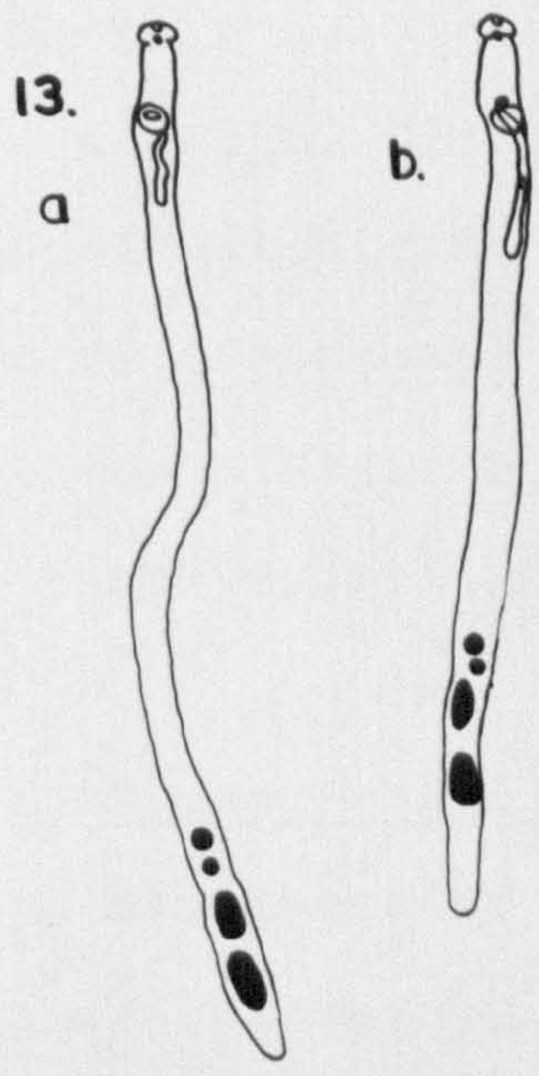
Himasthla elongata (Mehlis, 1831)

Figure 13b. Complete specimen. Diagrammatic.

11.



13.



9) Himasthla leptosoma (Creplin, 1829) Dietz, 1909 b.

Syns. Distoma leptosoma Creplin, 1829

Echinostoma leptosomum (Creplin, 1829) Cobbold, 1861

Distomum leptosomum (Crep., 1829) Villot, 1879

Echinostomum leptosomum (Crep., 1829) Stossich, 1892

Distomum leptosomum (Crep., 1829) Dietz, 1909 a

Himasthla secunda (Nicoll, 1906) Dietz, 1909 b

Distoma leptosoma was first described by Creplin (1829) from the Dunlin (Calidris alpina (L.)). Cobbold (1861) transferred the species to Echinostoma but gave no redescription. Villot (1879) refers to Distomum leptosomum and Stossich (1892) to Echinostomum leptosomum. Dietz (1909 b) transferred the species to his new genus Himasthla and in 1910 gave a redescription based on the material of previous workers from Berlin and other museums. Sprehn (1932) synonymised both militaris (Rud., 1802) and H. secunda (Nicoll, 1906) with this species, a classification followed by Dawes (1946). Skrjabin (1956) did not include secunda as the description was not available to him. Yamaguti (1958) lists secunda as a synonym of leptosoma, citing Yamashita (1937), but considers militaris to be a valid species. Yamashita (1937) merely lists secunda as a synonym without any reason in the text.

Nicoll (1906) described Echinostoma secundum from the Herring Gull (Larus argentatus Pont.), the Black-headed Gull (Larus ridibundus L.) and the Oystercatcher (Haematopus ostralegus L.). Dietz (1909 b) transferred it to Himasthla and in 1910 differ-

entiated it from leptosoma, militaris, elongata, alincia and the type species rhigedana. A specimen compatible with Nicoll's description has not been recovered from any of his original hosts and as time has not allowed for a re-examination of Nicoll's original material, the synonymity with leptosoma is not discussed.

British records include Lebour (1905) from the Herring Gull, McIntosh and Nicoll (1927) from the Dunlin, Purple Sandpiper (Calidris maritima Brünnich) and the Turnstone (Arenaria interpres L.), Baylis (1928) from the Knot (Calidris canutus (L.)), Soloman (1934) from the Herring Gull, Davies (1937, unpubl.) from the Dunlin, Walker (1937) from the Dunlin, Baylis (1939) from the Dunlin and the Bar-tailed Godwit (Limosa lapponica (L.)), Jennings and Soulsby (1957) from the Black-headed Gull, Pemberton (1960) from the Curlew, and Pemberton (1963) from the Black-headed Gull, the Herring Gull and the Lesser Black-backed Gull. None of these authors provided a redescription of the material.

Previous Welsh records are those of Davies and Walker mentioned above. The present writer records Himasthla leptosoma from the Dunlin, (six mature specimens from one bird only - Winter, 1962), the Turnstone (four immature specimens from a single bird - Summer, 1962) and the Redshank (Tringa totanus (L.)) (one mature and two immature specimens from the only bird of this species examined - Winter, 1962). The single mature specimen from the Redshank was stained and mounted for identification, so the following redescription is based on this single specimen and five of the six mature specimens from the Dunlin.

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Plate 10

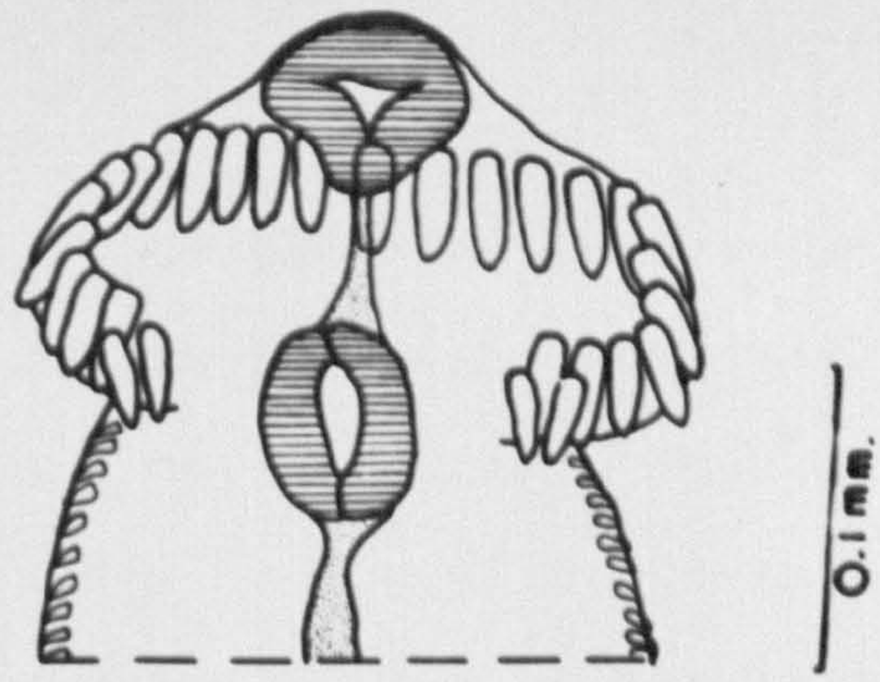
Himasthla leptosoma (Creplin, 1829)

Figure 14. Head with spines.

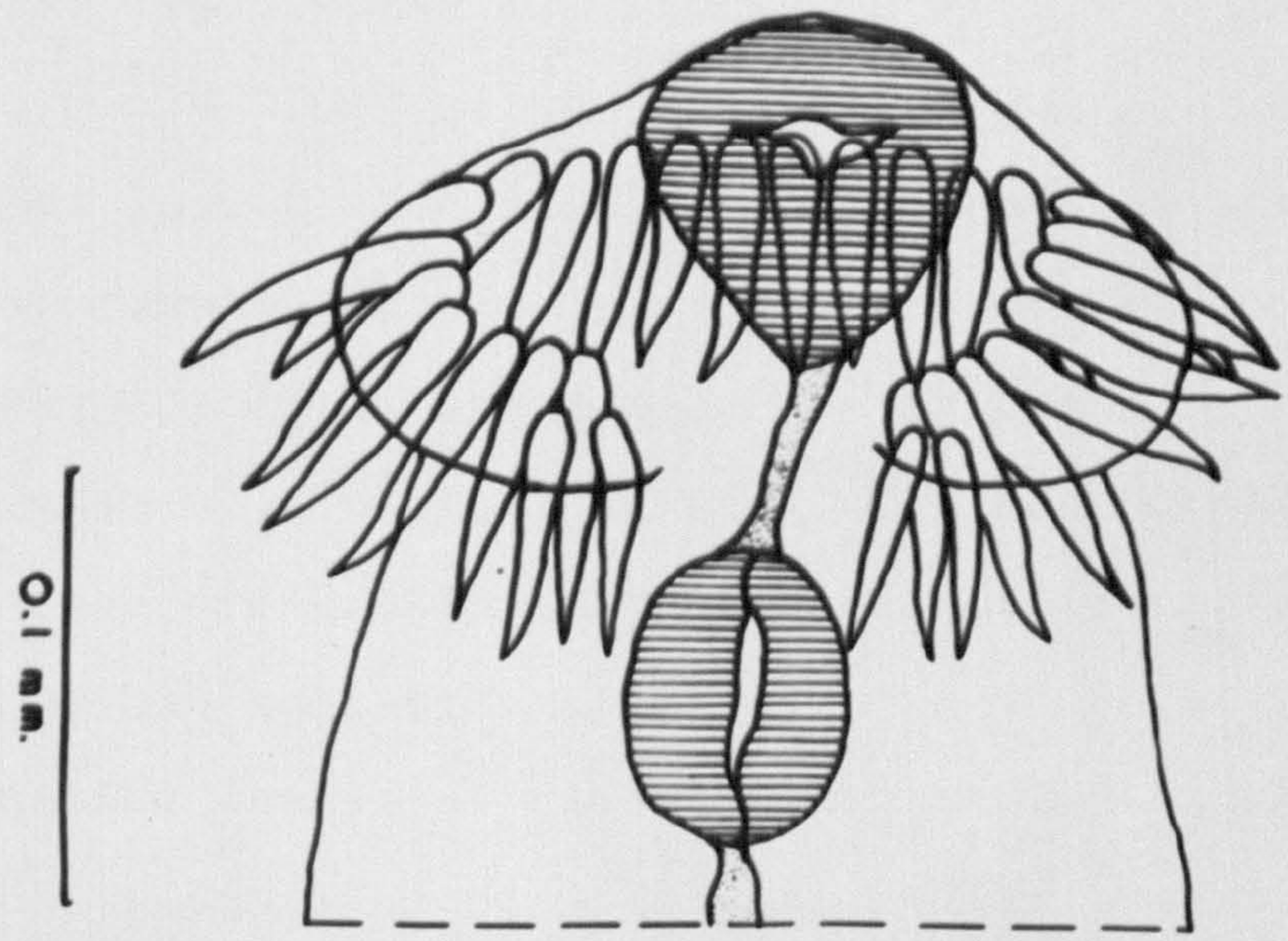
Himasthla elongata (Mehlis, 1831)

Figure 15. Head with spines.

14.



15.



The remaining specimen from this last host was sectioned to assist in the writing. The measurements below are the mean of the adult specimens mounted.

External Morphology

The off-white trematode is found in the anterior part of the small intestine. The length in mature specimens was found to be fairly constant between 7 mm. and 8 mm. (Mean 7½),(Figure 13 a).

The head is surrounded by a similar fleshy collar to that of the rhigedana which is incomplete on the ventral side. There are twenty-five "perimeter" spines (0.033 mm. long, 0.012 mm. at the base) which are somewhat bigger on the dorsal surface than laterally. A pair of "corner" spines underlie the terminal "perimeter" spine at each side (0.026 mm. long, 0.09 mm. at the base). The spines are markedly peg-shaped, (Figure 14).

Behind the collar the body spines are found in very compact alternating rows. Each spine is triangular with a length of 0.009 mm. and 0.006 - 0.007 mm. at the base. The distance between individual spines is not more than 0.003 mm. and the alternation between adjacent rows gives the impression of scales rather than spines. The body spines in the region of the ovary are distinctly smaller and slimmer (0.006 mm. long and 0.003 mm. at the base). The individual rows are 0.0215 mm. apart and it is difficult to determine whether the spination of adjacent rows is alternate or parallel. Spination ceases at the anterior testis.

The head has a diameter of 0.215 mm., while the sharp constriction behind the collar at the level of the pharynx is

0.165 mm. across. The greatest body width is found across the ventral sucker (0.287 mm.), while in the mid-body or uterus region it is 0.201 mm. (A reason for the uniformity in this area is given in the description of the uterus below). Across the testes the body diameter is 0.28 mm.

The oral sucker is terminal and directed ventrally at an angle of about 30°. It is broader than long, (0.075 mm. wide, 0.065 mm. long), funnel-shaped, with an opening 0.031 mm. across. The large globular ventral sucker is 0.189 mm. long and 0.186 mm. broad. The opening is 0.087 mm. across. The sucker is 0.7 mm. from the anterior end, that is $\frac{1}{10}$ th. of the body length away.

Internal Morphology

a) Alimentary canal

A short, thin-walled prepharynx (0.016 mm. long) leads into the muscular pharynx (0.073 mm. long and 0.05 mm. wide), the walls of which are 0.021 mm. thick. The oesophagus is 0.27 mm. long and bifurcates just in front of the genital atrium into two lateral caeca. The caeca are 0.049 mm. in diameter and continue to a point 0.195 mm. from the posterior end of the body.

b) Musculature

The cuticle is 0.0065 mm. thick and is supported on a basement membrane. The musculature of the body wall consists of an outer circular layer, a middle longitudinal layer and inner oblique layer, each of which is 1 fibre thick. The greatest concentration of muscles is found in the region between the oral and ventral suckers. A layer of subcuticular cells complete the body wall.

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Plate 11

Himasthla leptosoma (Creplin, 1839)

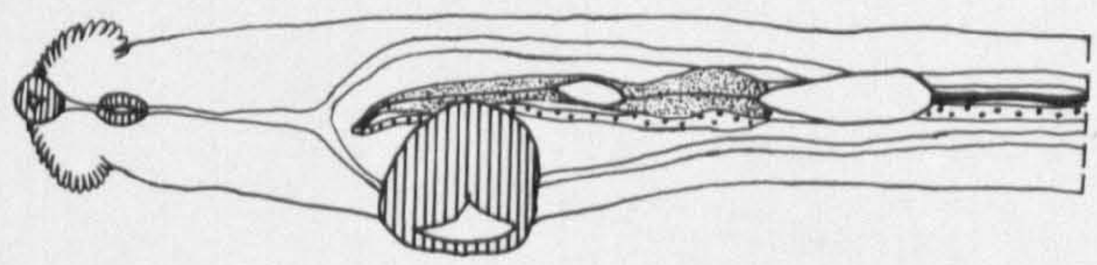
Figure 16. Head with cirrus sac.

Figure 17. Posterior end.

Himasthla elongata (Mehlis, 1831)

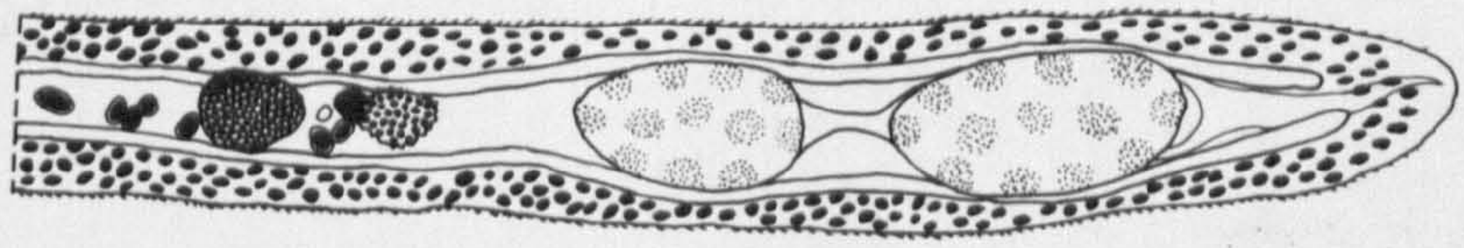
Figure 18. Posterior end.

16.

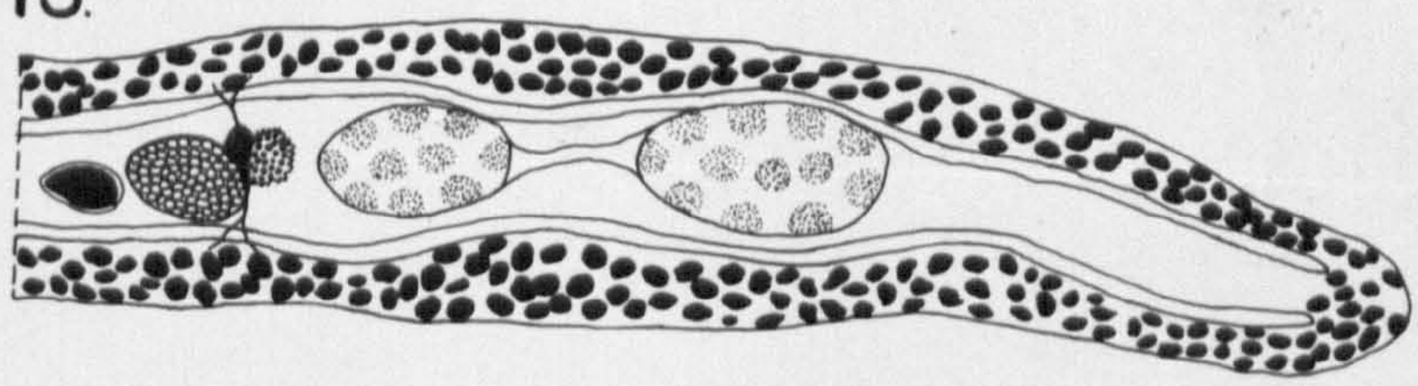


0.5 mm.

17.



18.



c) Excretory system

The Y-shaped bladder fills the end of the body behind the posterior testis. The two main lateral excretory ducts empty into the arms of the Y. The excretory pore opens subterminally on the ventral side about 0.015 mm. from the tip, though this may be due to flattening when mounting the specimens.

d) Reproductive system - Male

The oval testes are found in tandem in the posterior quarter of the body, (Figure 17). The posterior testis (0.366 mm. long and 0.187 mm. broad) is slightly larger than the anterior (0.315 mm. long, 0.171 mm. broad). The distance between them is 0.112 mm. while the posterior testis is 0.346 mm. from the hind end of the body. The vas efferens of each testis arises ventro-laterally from the mid-region and runs forward to unite with the corresponding duct as the vas deferens, 0.24 mm. behind the cirrus. The vas deferens expands within the cirrus sac to form the internal seminal vesicle. The cirrus sac is 0.742 mm. long and in the region of the internal seminal vesicle 0.082 mm. wide. The thin-walled seminal vesicle is 0.326 mm. long, that is less than half the cirrus length. There is a slight constriction between the seminal vesicle and the pars prostatic region, which is 0.2 mm. long and consists of a thin-walled central duct surrounded by pear-shaped gland cells. In this region the cirrus sac is approximately 0.037 mm. wide. The ductus ejaculatorius is slightly more muscular and flask-shaped, and is continuous with the cirrus, (Figure 16). The cirrus is rather more muscular and

constitutes the remaining 0.2 mm. of the cirrus sac. The cirrus was not everted in any of the five mounted specimens, and it was not possible to determine the presence of spines in the inverted cirrus. The genital atrium is shallow and found in the bifurcation of the intestine, 0.035 mm. in front of the ventral sucker. There is no external seminal vesicle.

e) Reproductive system - Female

The near-spherical ovary (0.124 mm. long, 0.115 mm. broad) is found in the midline, 0.36 mm. from the anterior testis. This distance is equal to that of the testis length (Figure 17). The oviduct arises from the postero-dorsal margin and runs posteriorly towards the dorsal surface receiving Laurer's canal and the median yolk duct. Mehlis' gland is 0.115 mm. long and 0.1 mm. broad, and situated in the midline, 0.175 mm. in front of the anterior testis. It is ventral and slightly posterior to the median yolk reservoir. The uterus emerges from the ventral side of Mehlis' gland. Whether the five specimens mounted had only recently reached maturity cannot be stated with certainty, but, unlike the convolutions of the uterus shown in the drawings of previous workers, the uterus continues as a straight tube to the genital atrium, the eggs being singly arranged. The lack of expansion of the gravid uterus accounts for the uniformity in size of the body between the testes region and the ventral sucker mentioned above. The writer is convinced that these are newly mature specimens and that more mature forms would show the mass of eggs figured by other workers. In addition there is no distinctive

TABLE 11 Himasthla leptosoma (Creplin, 1839) Dietz, 1909

Characters	Dietz, 1910	Author	Secunda Nicoll, 1906
Length	6.0 - 10.5	7.5	5.4 - 7.3
Diameter Head	0.2 - 0.24	0.215	0.33
" behind head	0.18 - 0.2	0.165	0.27
" across V.S.	0.21 - 0.27	0.287	0.52
" uterus	0.2 - 0.25	0.201	-
" testes	-	0.28	0.7
Head Spines	29 (25-2-2)	29 (25-2-2)	29 (25-2-2)
"perimeter	0.034 - 0.048 X 0.009 - 0.012	0.033 x 0.012	0.05 - 0.053
"corner"	0.027 - 0.038 X 0.009 - 0.01	0.026 x 0.009	0.026
Body Spines		numerous	numerous
Between O.S. - V.S.	-	0.009 x 0.006	"little increas
Ovarian region	-	0.006 x 0.003	in size"
Distance between rows	-	0.021	-
Extent	-	Head to anterior testis	Not in posterior third
Oral Sucker	0.061 - 0.08	0.065 x 0.075	0.11
" " opening	0.013 - 0.015	0.031	-
Prepharynx	0.013 - 0.065	0.061	0.035
Pharynx	0.07 x 0.05	0.073 x 0.05	-
" wall thickness	0.02 - 0.04	0.021	-
Oesophagus	0.24 - 0.34	0.27	0.47
Caecum width	-	0.049	-
Distance from body end.	-	0.195	-
Ventral Sucker	0.18 - 0.22	0.189 x 0.186	0.33
" " opening	0.093 - 0.11	0.089	-
Distance O. - V.	-	0.5 - 0.7	0.7
Anterior testis	0.41 - 0.55 X 0.19 - 0.23	0.315 x 0.171	0.66 x 0.4
Posterior testis	0.45 - 0.62 X 0.2 - 0.23	0.366 x 0.187	0.8 x 0.
Distance between	0.003 - 0.036	0.112	-
Distance from body end	0.35 - 0.45	0.346	0.94
Cirrus sac	0.68 x X 0.16 - 0.17	0.742 X 0.052 - 0.082	-
Cirrus	-	0.2	-
Seminal Vesicle	-	0.326	-
Ovary	0.1 - 0.15	0.124 x 0.115	0.27 x 0.2
Distance from testis	0.16 - 0.26	0.36	-
Mehlis' gland	-	0.115 x 0.1	-
Yolk follicle	-	0.031	-
Yolk extent	Not to Cirrus	0.428 m from Cirrus	0.52 m.m. from V.S.
Eggs	0.096 x 0.062	0.09 x 0.055	0.082 x 0.053

thickening of the uterus at the region of the metraterm. The yolk glands are up to 0.031 mm. in the testes region and extend from the posterior end of the body to 0.428 mm. from the cirrus sac.

The largest egg found was 0.09 mm. long and 0.055 mm. broad (Figure 19 a) at a point midway between the ovary and the ventral sucker end.

Discussion

The above redescription is the first since that of Dietz (1910). A comparison with Dietz' measurements as given in Table 11 show that they are, in the main, compatible, but the following differences are noted:-

a) The head spines, testes, distance between the testes and the eggs are all somewhat smaller;

b) The oral sucker, ovary, distance between the ovary and testes and the cirrus sac are all rather larger.

The description given is considerably more detailed than that of Dietz (1910) and in particular the body spination is described for the first time. The measurements given by Nicoll (1906) for H. secunda are added to the Table for interest, even though it has not been possible to examine his type specimens.

Himasthla leptosoma has been found by this writer in the Dunlin, the Turnstone and the Redshank. The Redshank is a new host.

It is now proposed to differentiate H. leptosoma (Creplin, 1829) from H. rhigedana (Dietz, 1909 the type spp.).

A comparison between Figure 12 relating to rhigedana and Figure 17 relating to leptosoma reveals remarkable differences, particularly when it is appreciated that both figures are drawn to the same scale. The differences in size of the two species and their organs are seen by comparing the respective columns in Table 13, and are constant enough in the limited material available to have specific value. They are given in the resumé below.

	rhigedana	leptosoma
Body length	11.8 - 13.1 mm.	7.5 mm.
Maximum body width	0.56 mm	0.28 mm.
Oral sucker	0.1 - 0.138 mm.	0.65 mm.
Ventral sucker	0.249 - 0.312 mm.	0.189 mm.
Pharynx	0.095 - 0.1 mm.	0.073 mm.
"Perimeter" spines	0.055 - 0.063 mm.	0.033 mm.
"Corner" spines	0.055 mm.	0.026 mm.
Anterior testis	0.63 - 0.77 mm.	0.315 mm.
Posterior testis	0.645 - 0.812 mm.	0.366 mm.
Cirrus sac	1.02 - 1.126 mm.	0.742 mm.
Ovary	0.192 - 0.204 mm.	0.124 mm.
Mehlis' gland	0.142 mm.	0.115 mm.
Yolk follicles (testes region)	0.075 mm.	0.031 mm.
Egg size	0.096 - 0.105 mm.	0.09 mm.

Dietz' statement that the extent of the yolk glands for both leptosoma and rhigedana is the same, that is, it falls short of the cirrus sac, has not been found to be true for the writer's

rhigedana specimens and adds further evidence for the differentiation of the two species, as does the actual number of the head spines.

All these measurements which, for the most part, agree with those of Dietz can easily be explained by the difference in size of the two species, (except the extent of the yolk glands). This writer adds the incompatibility of proportional relationships between the various reproductive organs of the two species. Thus, while the distance between the anterior testis and the ovary in both is approximately equal to the testis length (though this may be much greater in rhigedana - see Figure 12), the distance between the individual testes is markedly and constantly different In rhigedana the testes are 0.63 mm. and 0.654 mm. long respectively, while the distance between them is always equal to this length and may greatly exceed it (0.681 - 1.368 mm.). In leptosoma the distance between the testes was seen to be approximately half the testes length, as comparison of Figure 12 (rhigedana)and Figure 17 (leptosoma) illustrates. To this may be added the difference in distance between the posterior testis and the end of the body. In rhigedana the distance is infrequently equal to the testis length and more often greatly exceeds it, but in leptosoma this distance is equal to the testes length and did not exceed it to a relevant extent in any of the specimens.

To these proportional differences are now added the measurements relating to the body spines which were not mentioned by Dietz. The spines of rhigedana are of constant size throughout

the body (0.013 mm. long, 0.005 mm. at the base). In the oral - ventral sucker region they are considered to show parallel spination in the adjacent rows and in the testicular region the rows are separated by a constant difference of 0.078 mm. In leptosoma the oral - ventral sucker body spines (0.009 mm. long, 0.006 - 0.007 mm. at the base) are not only more triangular in shape than those of the main body but larger, (0.006 mm. long, 0.003 mm. at the base). Also the spination of adjacent rows between the oral and ventral suckers is alternate. Finally, in the testicular region adjacent rows are separated by only 0.0215mm.

A further minor difference can be seen in the shape of the cirrus sac at the junction of the internal seminal vesicle and the pars prostatica. In rhigedana there is a distinct 'twist', while in leptosoma the cirrus sac continues a straight course, as is obvious when leptosoma Figure 16 and rhigedana Figure 11 are compared.

That leptosoma (Creplin, 1829) as defined by Sprehn, (1932) and Dawes, (1946) must also include all species with twenty-nine head spines (with the possible exception of multilecithosa Mendheim (1940) which has four 'corner' spines at each side) is obvious when comparing the measurements of the seven existing species given in Table 14. If this be true, all the species must fall to Himasthla militaris (Rud., 1809). This can only be determined satisfactorily by experimental cross-infections of all seven species to assess whether specific differences are maintained.

10). Himasthla elongata (Mehlis, 1831) Dietz, 1909 b

Syns.: Distomum elongatum Mehlis, 1831

Echinostomum elongatum (Mehlis, 1831) Stossich, 1892

Distomum elongatum (Mehlis, 1831) Dietz 1909 a

Mehlis (1831) described Distomum elongatum from the Herring Gull (Larus argentatus Pont.) and the Great Black-backed Gull (Larus marinus L.) in Germany. His description is short, without illustrations and principally concerned with differentiating the species from Distomum leptosomum Creplin, 1829. Stossich (1892) refers to this species as Echinostomum elongatum and the first major redescription is that of Dietz (1910) where he differentiates elongata from the other five species in his new genus Himasthla. A further description is found in Linton (1928) where he records elongata from the Herring Gull, the Great Black-backed Gull, the Delaware Gull (Larus delawarensis Baird), the Philadelphia Gull (Larus philadelphia Gray) and the Night Heron (Nycticorax nycticorax (L.)). Mendheim (1940) gave measurements for elongata when describing his new species H. multilecithosa.

The first British record that the writer has traced is that of Lewis (1926) from the Herring Gull at Aberystwyth. McIntosh and Nicoll (1927) record elongata from the Herring Gull and the Black-headed Gull at St. Andrews, and Davies (1937, unpubl.) records elongata from four out of eleven Herring Gull at Aberystwyth. Walker (1937) recorded the species from the Redshank (Tringa totanus (L.)) on the Gower Peninsula, while the most recent record is once again from Aberystwyth - Williams (1962).

Walker failed to give a redescription in both his unpublished M.Sc. Thesis and his published summary (1937). Since H. leptosoma is recorded by this writer from the Redshank as a new host record, there is a doubt about the validity of Walker's record.

Himasthla elongata was found in a dead Herring Gull given to the writer in the Spring of 1962. Auto-digestion had commenced and the material was in poor condition. Six specimens were recovered, two of which are linked in the region of the ventral sucker. Unfortunately, the bad condition of the material makes it impossible to state whether or not cross-fertilization is taking place. The necessity of staining and mounting all the specimens to obtain adequate identification has, under the circumstances, meant that no sections have been made from these trematodes. The results of sectioning would, in any case, have been difficult to interpret in this instance. The condition of the worms makes it doubly regrettable that no other Herring Gull, of the seventeen examined, proved to be infected.

External Morphology

The off-white trematodes were coiled and distorted, but straightening the specimens under cover-slips prior to staining, gave a total length of 6 - 6.5 mm.

The head is surrounded by the fleshy collar, incomplete on the ventral side, already described above. The twenty-nine head spines are considerably larger than those of leptosoma however, and of an altogether different shape, being "carrot" rather than "peg" shaped (Figure 15). The twenty-five "perimeter"

spines vary between 0.052 mm. and 0.068 mm. long on the different specimens, (0.007 - 0.012 mm. at the base), and the "corner" spines measure 0.047 - 0.063 mm. long (0.006 - 0.01 mm. at the base).

The body spines were not found on any of the six specimens. The head diameter is 0.22 mm., and the constriction behind the collar 0.135 mm. in diameter. The funnel-shaped oral sucker is 0.08 mm. long and 0.09 mm. broad, the opening varying between 0.045 mm. and 0.05 mm. The ventral sucker, which is approximately $\frac{1}{9}$th - $\frac{1}{12}$th of the body distance away, is globular with a diameter of 0.25 mm. and an opening measuring 0.09 mm.

The body diameter across the ventral sucker is 0.4 mm. and across the uterus 0.346 mm. (This last is an especially dubious measurement due to the distortion of the body in this region.) The maximum diameter across the posterior testis is 0.293 mm.

Internal Morphology

a) Alimentary canal

A short prepharynx (0.05 mm.) leads into the small but very muscular pharynx, which is 0.07 mm. long and 0.05 mm. broad, with a wall thickness of 0.02 mm. The oesophagus (0.37 mm.) bifurcates prior to the genital atrium into two lateral caeca which are 0.028 mm. wide. In the posterior end the respective caeca are obscured by the density of yolk follicles but the distance between the caeca and the body tip does not exceed 0.12 - 0.15 mm.

b) Musculature

Because of the inadequacy of the material sectioning was

not attempted. The cuticle on the lateral side was found to be between 0.006 - 0.008 mm. thick.

c) Excretory system

The vesicle was obscured both by the density of the yolk follicles and the distortion of the poor material.

d) Reproductive system - Male

The testes are found in the midline in the posterior quarter of the body (Figure 13 b). They are elongate-oval, with the hindmost slightly larger. The anterior testis did not exceed 0.332 mm. long and 0.12 mm. wide in any specimen, and likewise the posterior did not exceed 0.339 mm. long and 0.19 mm. wide. The distance between varied from 0.121 - 0.34 mm. but rarely exceeds testis length, while the distance to the end of the body varied from 0.56 - 0.82 mm., that is at least a testis length and possibly more than twice that length (Figure 18).

The vasa efferentia and vas deferens could not be distinguished. The cirrus sac is voluminous and passes dorsally over the ventral sucker, on the left of the metraterm, to open in the genital atrium, which is a shallow opening 0.055 mm. in front of the ventral sucker. The maximum length of the cirrus is 1.11 mm. and in the internal seminal vesicle region is 0.108 mm. wide. The seminal vesicle is 0.52 mm. long, that is, it occupies nearly half the length of the cirrus sac. There is no external seminal vesicle. Unlike leptosoma there is a definite spiralling of the body of the sac between the seminal vesicle and the pars prostatica. This latter body occupies a further 0.27 mm., the

TABLE: 12 *Himasthla elongata* (Mehlis, 1839) Dietz, 1909

Characters	Dietz, 1910	Author
Length	7.0 - 8.5	6.0 - 6.5
Diameter Head	0.308 - 0.354	0.22
" behind head	0.261 - 0.308	0.135
" across V.S.	0.43 - 0.58	0.4
" uterus	-	0.346
" testes	0.41 - 0.57	0.293
Head Spines	29 (25-2-2)	29 (25-2-2)
"Perimeter"	0.057 X 0.013 - 0.014	0.052 - 0.068 X 0.007 - 0.02
"Corner"	0.031 - 0.041 X 0.009 - 0.012	0.047 - 0.063 X 0.006 - 0.01
Oral Sucker	0.15 - 0.129	0.08
" " opening	0.047 - 0.054	0.045
Prepharynx	0.02 - 0.03	0.05
Pharynx	0.109 x 0.068	0.07 x 0.005
" wall thickness	0.032	0.02
Oesophagus	0.04 - 0.06	0.037
Caecum width	-	0.028
Ventral Sucker	0.308 - 0.338	0.25
" " opening	0.055 - 0.083	0.09
Anterior testis	0.338 - 0.4 X 0.2 - 0.23	0.332 x 0.12
Posterior testis	0.369 - 0.465 X 0.2 - 0.23	0.339 x 0.19
Distance between	0.096 - 0.98(!)	0.121 - 0.34
Distance to body end	0.72 - 0.83	0.56 - 0.82
Cirrus sac	1.08 - 1.12 X 0.138 - 0.154	1.11 x 0.108
Seminal Vesicle	-	0.52
Ovary	0.15 - 0.18	0.16 x 0.118
Distance from testis	-	0.07 - 0.198
Mehlis' gland	-	0.068
Yolk follicle	-	0.036 - 0.042
Extent of yolk	reaches Cirrus sac	reaches Cirrus sac
Eggs	0.117 - 0.122 X 0.076 - 0.078	0.115 - 0.138 X 0.066 - 0.074

remaining 0.32 mm. comprising the ductus ejaculatorius and the cirrus. No spines were observed and no everted cirrus was found. At the genital atrium the cirrus was 0.037 mm. wide.

e) Reproductive system - Female

The ovary is an oval body in the midline, 0.07 - 0.198 mm. in front of the anterior testis. This is on average less than half the testis length and a much shorter distance than that found in rhigedana and leptosoma. The ovary itself is 0.16 mm. long and 0.118 mm. wide. Mehlis' gland and yolk reservoir occupy nearly all the space between the ovary and the testes, the diameter of Mehlis' gland being only 0.068 mm. The uterus emerges from the ventral side of Mehlis' gland and runs forward, greatly coiled, to open in the genital atrium. The length of the metraterm, which constitutes a thickened muscular portion at the proximal end of the uterus, could not be determined.

The yolk follicles are rounded structures on either side of the body which extend from the hind end of the cirrus pore to the posterior tip of the body, where their density tends to obscure the caeca and the excretory vesicle. The follicles vary between 0.036 - 0.04 mm. in the testes region.

The eggs are thick-shelled and yellow in colour. They are relatively enormous when compared with leptosoma and rhigedana, having a length of up to 0.115 mm. in Mehlis' gland region, and up to 0.138 mm. at the genital atrium (Figure 19 c).

Discussion

The writer's and Dietz' measurements as shown in Table 12

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Plate 12

Figure 19. Eggs.

a). H. leptosoma

b). H. rhigedana

c). H. elongata

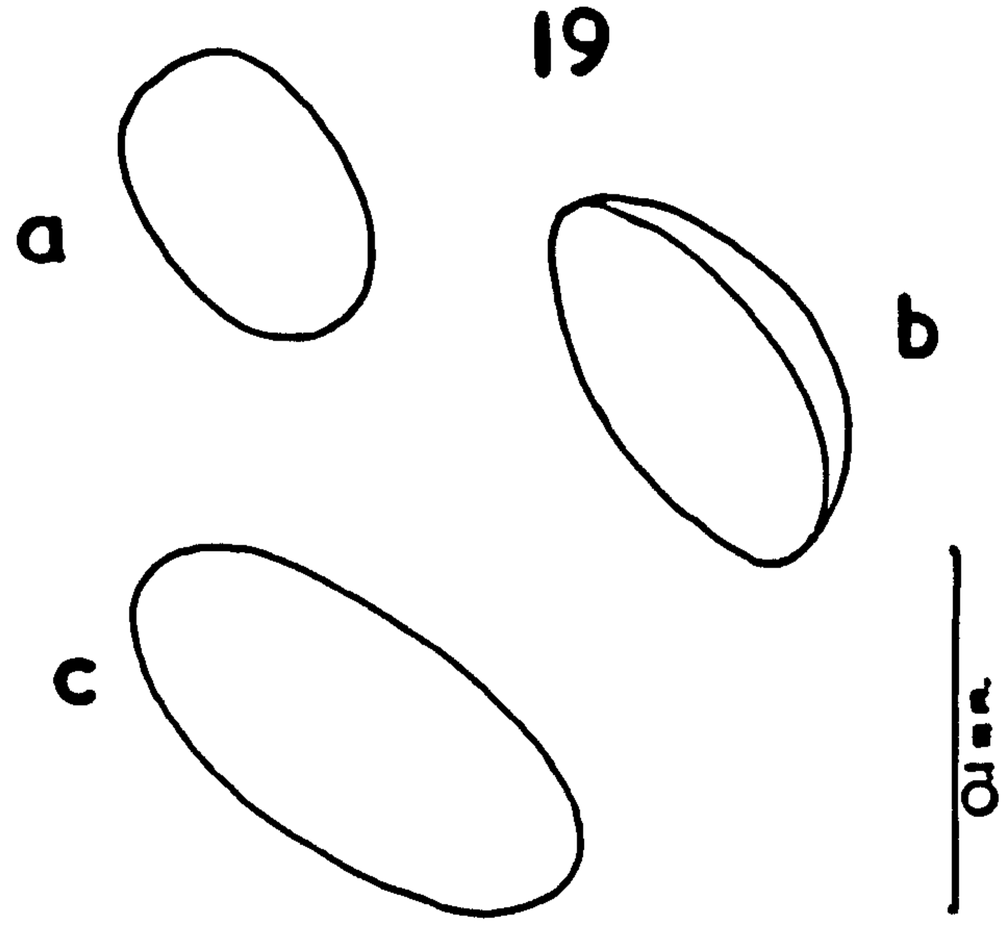
Figure 20. Diagrammatic comparison of the posterior ends of the three Himasthla species.

a). H. rhigedana

b). H. leptosoma

c). H. elongata

19



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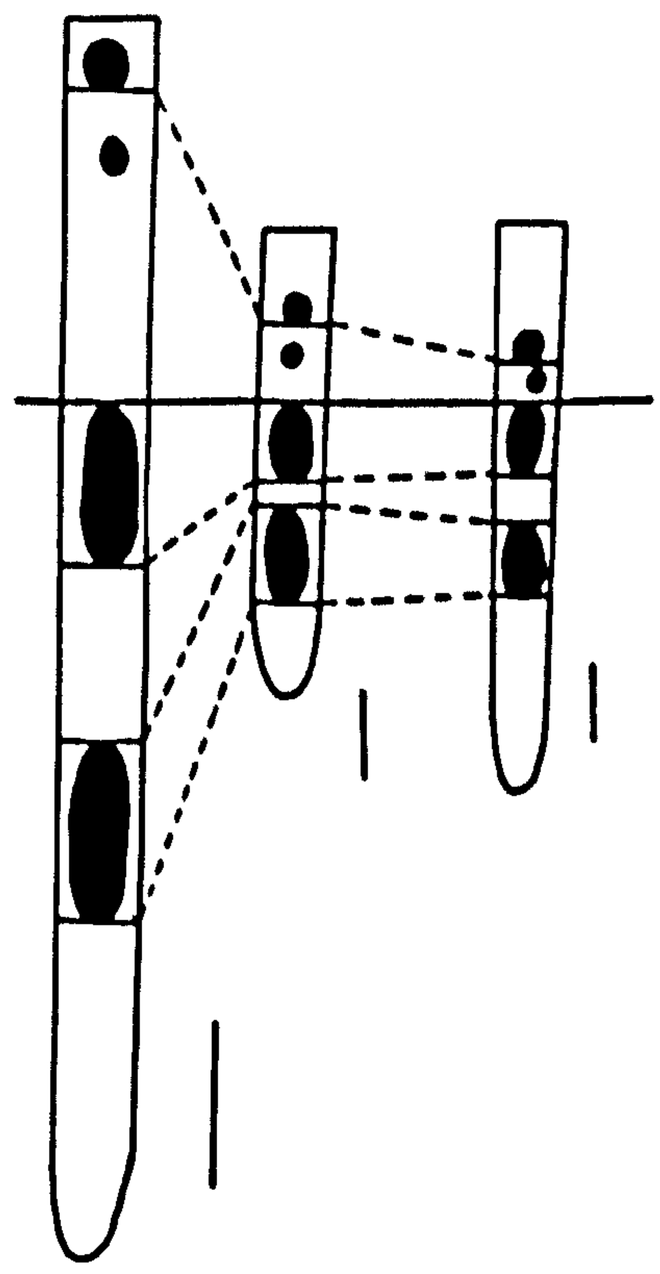

are compatible when it is realised that the smaller specimens of the writer give rise to proportionally smaller individual measurements. The only remarkable differences are the larger head spines (particularly the 'corner' spines) and the larger eggs, while the most questionable difference is Dietz' measurement for the distance between the testes, where his second figure appears to be a misprint. The distances between the oral and ventral sucker are proportionally the same compared with the body length, according to both Dietz and the writer.

It is possible to differentiate elongata from the type species rhigedana on much the same grounds as for leptosoma but the greater difficulty is experienced in differentiating elongata from leptosoma. The differences found by this writer may be enumerated:-

a) the egg size is much larger in elongata (Figure 19),
b) the yolk gland extent is greater in elongata,
c) the yolk follicles are consistently larger in elongata,
d) the cirrus sac is bigger and exhibits the spiralling between the internal seminal vesicle and the pars prostatica in elongata,
f) the head spines are twice as big in elongata,
g) the proportional relationships of the gonads differ - the distance between the ovary and the anterior testis is less than half the testis length in elongata, while in leptosoma it is equal to this length and may exceed it; the distance between the testes in both species is only half the testis

length but in elongata only does it exceed a testis length; in leptosoma the distance between the posterior testis and the body end equals or slightly exceeds a testis length, but in elongata this length is always much exceeded and may be nearly trebled. (See leptosoma Figure 17 and elongata Figure 18).

Figure 20 shows the overall body proportional relationships using the tip of the anterior testis as a ground from which to express the proportions. All specimens are drawn to the same scale and represent an identical ground plan to the enlarged, detailed drawings that accompany the appropriate section of the text. The small scale to the right of each posterior end is, for each individual, a mean of the testes lengths. This can be plotted against each ground plan and the differences in the proportional relations of the gonads demonstrated. That on the left is rhigedana, in the middle is leptosoma, and on the right elongata.

The literature shows a great deal of variation in the descriptions of elongata and the illustrations of, for example, Stunkard (1960) and particularly the proportional relationships of the gonads therein, correspond equally well with either the writer's leptosoma or elongata.

The futility of differentiating species on so meagre a number of specimens is self-evident, particularly when the leptosoma specimens were not fully mature and it is possible that a larger sample of each species would have shown such an overlap in the range of characters, that differentiation would

TABLE: 13 *Himasthla* spp. compared - measurements of author

Characters	*rhigedana* (Dietz)	*leptosoma* (Creplin)	*elongata* (Mehlis)
Length	11.8 - 13.1	7.5	6.0 - 6.5
Diameter Head	0.226 - 0.346	0.215	0.22
" behind head	0.198 - 0.284	0.165	0.135
" across V.S.	0.34 - 0.49	0.287	0.4
" uterus	0.34 - 0.56	0.201	0.346
" testes	0.414	0.28	0.293
Head Spines	29 (25-2-2)	29 (25-2-2)	29 (25-2-2)
"Perimeter"	0.055 - 0.063 X 0.015 - 0.02	0.033 x 0.012	0.052 - 0.068 X 0.007 - 0.012
"Corner"	0.04 - 0.046 X 0.012 - 0.013	0.026 x 0.009	0.047 - 0.063 X 0.006 - 0.01
Body Spines	numerous	numerous	-
Between O.S. - V.S.	0.013 x 0.005	0.009 x 0.007	-
Ovarian region	0.013 x 0.005	0.006 x 0.003	-
Distance between rows	0.078	0.021	-
Extent	Head to posterior testis	Head to anterior testis	-
Oral Sucker	0.1 - 0.138 X 0.075 - 0.079	0.065 x 0.075	0.08 x 0.09
O.S. opening	0.075 - 0.1	0.031	0.045
Prepharynx	0.055	0.061	0.05
Pharynx	0.95 - 0.1 X 0.075 - 0.079	0.073 x 0.05	0.07 x 0.05
" wall thickness	0.028 - 0.035	0.021	0.02
Oesophagus	0.027 - 0.42	0.27	0.37
Caecum width	0.036	0.049	0.028
Distance from body end	0.25	0.195	-
Ventral Sucker	0.249 - 0.312 X 0.18 - 0.291	0.189 x 0.186	0.25
V. S. opening	0.132	0.089	0.07
Distance O.S. - V.S.	0.56 - 0.77	0.5 - 0.7	-
Anterior testis	0.63 - 0.77 X 0.148 - 0.187	0.315 x 0.171	0.332 x 0.12
Posterior testis	0.654 - 0.812 X 0.215 - 0.3	0.366 x 0.187	0.339 x 0.19
Distance between	0.374 - 0.82	0.112	0.121 - 0.34
Distance to body end	0.6 - 1.234	0.346	0.56 - 0.82
Cirrus sac	1.02 - 1.126 X 0.15 - 0.22	0.742 X 0.052 - 0.082	1.110 x 0.108
Cirrus	0.38	0.2	-
Seminal Vesicle	0.7	0.326	0.52
Ovary	0.192 - 0.204 X 0.145 - 0.154	0.124 x 0.115	0.16 x 0.118
Distance from testis	0.681 - 1.368	0.36	0.07 - 0.198
Mehlis' gland	0.142	0.115 x 0.1	0.068
Yolk gland	0.075	0.031	0.036 - 0.042
Extent of yolk	0.45 m.m. from V.S.	0.428 m.m. from Cirrus	reaches Cirrus sac
Eggs	0.096 - 0.105 X 0.053 - 0.069	0.09 x 0.055	0.115 - 0.138 X 0.066 - 0.074

have been impossible. As the species stand however, a differentiation concommitant with that of Dietz (1910) has been demonstrated in this text. Several workers have suggested that the various species of Himasthla with twenty-nine head spines are in fact only 'varieties' of one basic species, namely, Himasthla militaris (Rudolphi, 1802) Dietz, 1909.

Since variety of form within a single species can be a step towards the evolution of differentiable species, it is important to consider this aspect in relation to the two 'varieties' under discussion. Dietz in 1909, and again in 1910, was able to differentiate these two 'varieties' of Himasthla quite clearly and the fact that some fifty years later, species from the same respective hosts can be equally easily distinguished and additional evidence supplied, namely, the relative proportions in reproductive organ distribution, body spination and the cirrus sac form, one is forced to the conclusion that such constancy is due to specific or more exactly, genetic separation rather than to variation of a single species. The common ancestry of all species in the animal kingdom is indisputable but the consistency of differentiable characters over half a century suggests 'species evolved' rather than 'variety' within a species

Table 13 contains the measurements for the three species of Himasthla recovered by the writer.

TABLE: 14 *Himasthla* species with 29 head spines

Species	Body Length	Spines	"Perimeter" Spines	"Corner" Spines	Eggs	Host	Locality
1) *elongata* (Mehlis, 1831)	7.0 - 8.5	29 (25-2-2)	0.057 x 0.013 - 0.014	0.031 - 0.041	0.117 - 0.122	Herring Gull, Black headed Gull, Delaware, Philadelphia Gulls	Europe U.S.A.
" author	6.0 - 6.15	"	0.052 - 0.068	0.047 - 0.063	0.115 - 0.138	Herring Gull	Wales
2) *harrisoni* Johnston, 1917	12.0	24	-	-	0.091 - 0.096	*Numenius cyanopus*	Australia
3) *leptosoma* Creplin, 1839	6.0 - 10.5	29 (25-2-2)	0.034 - 0.048 x 0.009 - 0.012	0.027 - 0.038 X 0.009 - 0.01	0.096 x 0.062	Dunlin, Turnstone, Oystercatcher, Knot, *Larus* spp.	Europe
" author	7.5	"	0.033 x 0.012	0.026 x 0.009	0.09 x 0.055	Dunlin, Turnstone, Redshank	Wales
4) *megacotyle* Yamaguti, 1939	6.1 - 8.5	29 (25-2-2)	0.045 - 0.06	0.036 - 0.048	0.081 - 0.092	*Erolia alpina saphalina*	Japan
5) *rhigedana* Dietz, 1909	4 - 16.5	29 (25-2-2)	0.068 x 0.02	0.04 - 0.05 X 0.013	0.074 - 0.086 X 0.055 - 0.06	*Numenius arquatus* *Calidris maritima*	Europe
" author	11.8 - 13.1	"	0.055 - 0.063	0.04 - 0.046	0.096 - 0.105	Curlew, Whimbrel	Wales
6) *multilecithosa* Mendheim, 1940	5.0 - 7.8	29 (25-2-2)	0.056 - 0.06	0.032	0.08 - 0.093	*Goura coronata*	New Guinea
7) *secunda* Nicoll, 1906	4.5 - 7.3	29 (25-2-2)	0.05 - 0.053	0.026	0.082 - 0.093	Black-headed Gull	Europe

Family: PHILOPHTHALMIDAE, Travassos, 1918

S.F.: Parorchiinae nom. emend. Yamaguti, 1958
for Parorchinae, Lal, 1936

Genus: Parorchis, Nicoll, 1907

Syns.: Zeugorchis, Nicoll, 1906

Proctobium, Skrjabin, 1924

11) Parorchis pittacium (Braun, 1901) Nicoll, 1907 b

Syns.: Parorchis acanthus (Nicoll, 1906) Nicoll, 1907 a
Parorchis asiaticus Strom, 1927
Parorchis avitus Linton, 1914
Parorchis gedoelsti Skrjabin, 1924
Parorchis proctobium (Travassos, 1918)
Parorchis snipis Lal, 1936

In 1902 Braun described Distomum pittacium Braun, 1901, from Strepsilas interpres (now Arenaria interpres L.), the Turnstone, in Brazil. Four years later Nicoll described Zeugorchis acanthus from the Herring Gull (Larus argentatus Pont.) bursa fabricii and cloaca. He differentiated it from Pygorchis Looss, 1899, and Distomum pittacium Braun, 1901. The following year Nicoll published a note (1907, a) to the effect that Zeugorchis was occupied by a trematode from reptiles, and he changed the generic name to Parorchis. (Stafford, 1905 - Zeugorchis aequatus from Enteria sirtalis L. - the Common Garter Snake.) That same year he published a corrected and more detailed description (1907, b), based on living and preserved specimens. He suggested that it should be incorporated in the sub-family Philophthalminae Looss, 1899, and differentiated

P. acanthus from Pygorchis Looss, 1899, on the spines of the cephalic collar, the long oesophagus, the weakly developed cirrus and the asymmetrical lobed testes, but stated that D. pittacium Braun, 1901, was a synonym. Braun's species differs only in the lack of spines on the cephalic collar. In 1923, he regarded Parorchis as an echinostome and included it in the sub-family 'Para-echinostominae' (i.e. unclassified echinostomes) together with Echinostephilla virgula Lebour, 1909. Prior to this Odhner (1913) had included Parorchis in the Echinostomatidae and Poche (1925) followed suit. Strom (1927) transferred Parorchis back into the Philophthalmidae. Fuhrmann (1928) and Sprehn (1932) included it under 'isolated genera' of the Echinostomatidae, a classification which Dawes (1946) accepted. Lal (1936) differentiated Parorchis from true echinostomes on the following characters: presence of a receptaculum seminis (this is an incorrect interpretation of the receptaculum uterinum), testes intercaecal and adjacent, peculiar nature and distribution of the yolk follicles between the ventral sucker and the testes and the chambered excretory vessels. He created the new sub-family Parorchinae to receive Parorchis into the Echinostomatidae. The current classification will be given more fully, together with the writer's reasons for accepting the same, in the discussion below.

The cercaria was described by Lebour, 1911, (Cercaria purpurae) and the life cycle was first attempted by Lebour and Elmhirst (1927). The classic work of Rees (1939, 1940) is the

first complete account of the life cycle. Oguri and Chu (1955) working in Hawaii have published the results of feeding experiments on marine birds which were fed on squids, and domestic ducks fed on commercial poultry mash. The marine birds became 100% susceptible to P. acanthus and comparative faecal analyses showed the conspicuous absence of lacto bacilli.

British records include Nicoll, 1906, from the Herring Gull, 1907, from the Herring and Common Gulls (Larus canus L.); Ritchie, (1915) from the Herring Gull; Lewis, (1926) from the Herring Gull; McIntosh and Nicoll (1927) from the Herring and Common Gulls; (Davies, 1937 unpubl.) from the Herring and Great Black-backed Gulls, (Larus marinus L.); Rees, (1939) from the Herring Gull; Williams, (1962) from the Herring and Great Black-backed Gulls; and Pemberton, (1963) from the Herring, Lesser Black-backed (Larus fuscus L.), and the Black-headed Gulls (Larus ridibundus L.

The previous Welsh records are those of Lewis (1926), Davies (1937, unpubl.), Rees (1939) and Williams (1962) given above. The writer has found the trematode once in the Herring Gull (three specimens - July 1962), once in the Great Black-backed Gull (one specimen - August 1962) and once in the Curlew, (Numenius arquatus L.), (five specimens - November 1962). The specimens from the gulls were in the bursa fabricii and those from the Curlew were in the rectum. These latter specimens were very active and the characteristic looping movement between the oral and ventral suckers could be observed for two or three hours after dissection in a petri dish of saline. One of the Herring

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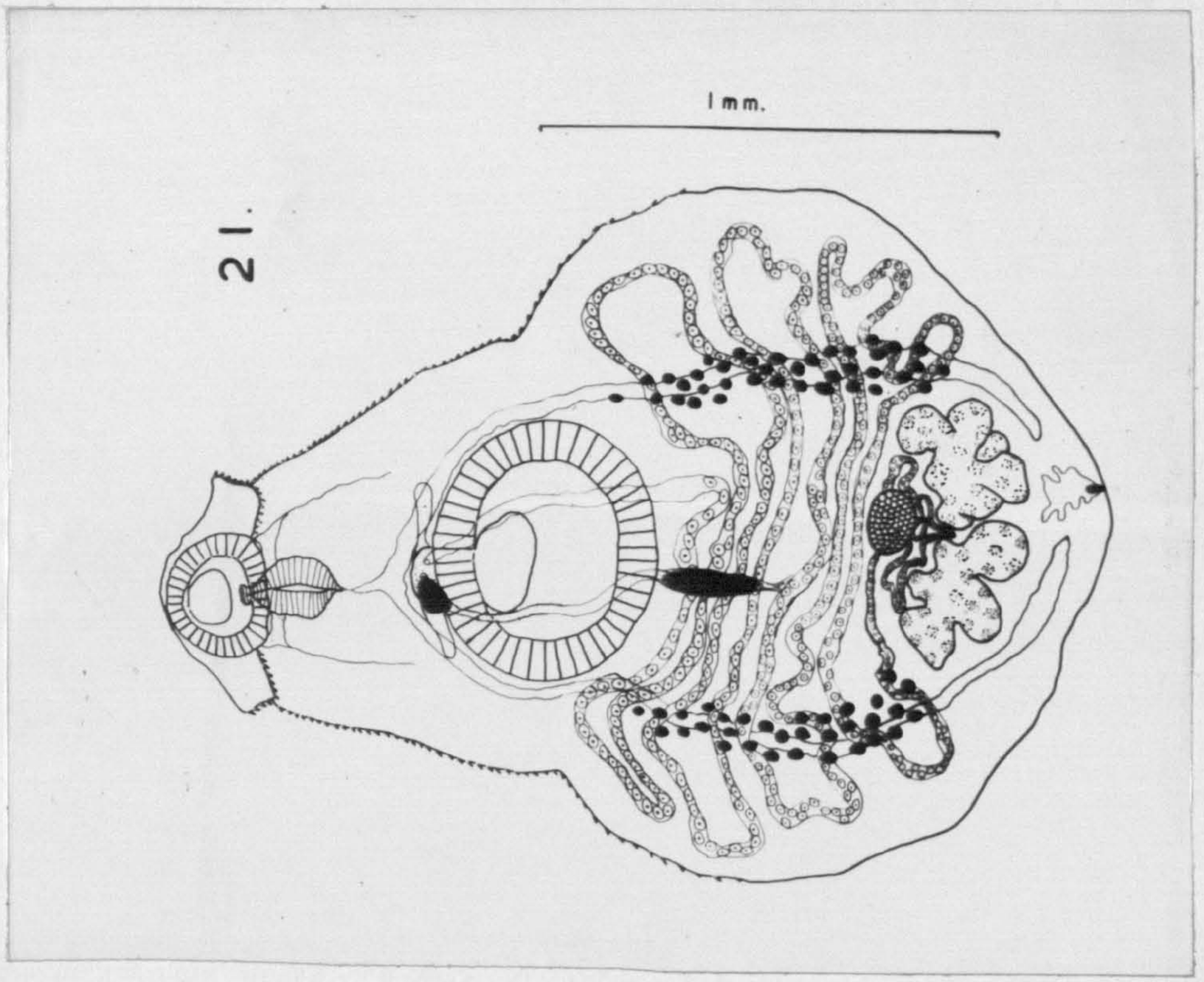
Plate 13

Parorchis pittacium (Braun, 1900)

Figure 21. Complete specimen.


1 mm.
21.

Gull specimens was sectioned.

External Morphology

Nicoll (1907 b) commented on the different shape assumed by the worm when contracted and when in the extended living condition. Figure 21 shows the contracted shape with a marked division of the body into a head (with collar), an anterior body region which is mainly pre-acetabular with a distinct pyramidal shape, and a broad, oval, posterior region. When fully relaxed the worm is near oval as shown in the diagrammatic Figure 22(b). The curlew specimens show this second form.

The size of the body is remarkably varied and the range is illustrated in Figure 22 where all the specimens are drawn to the same scale. Figure 22(a) is the Great Black-backed Gull specimen; Figure 22(b) the mean of the Curlew specimens and Figure 22(c) the mean of the Herring Gull specimens. Throughout the rest of the text the various host-forms will be referred to as (a), (b) and (c) for simplification.

The head is surrounded by a thick, fleshy collar which has a series of perimeter spines and is incomplete on the ventral side. The row of spines varies between 55 and 59 and have a length of 0.029 mm. to 0.033 mm. This is shorter than the measurements given by Nicoll (1906, 1907 b).

The pre-acetabular region is thick and muscular, convex on the dorsal surface and flat on the ventral surface. It is densely covered with body spines which are found in alternate rows. Their average length is 0.0185 - 0.0215 mm. and they are

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Plate 14

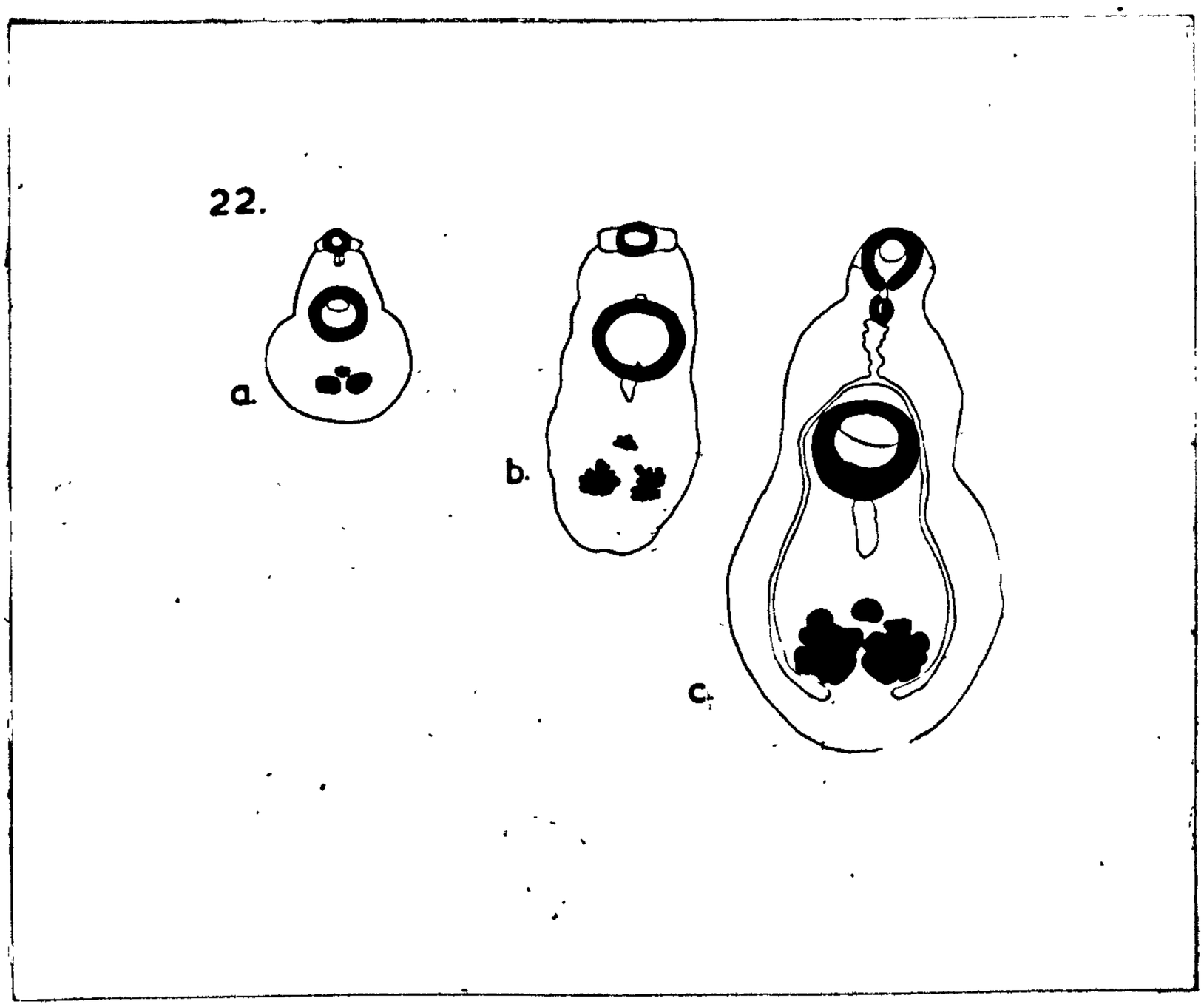
Parorchis pittacium (Braun, 1900)

Figure 22. Diagrammatic representation of the specimens recovered from three different hosts.

a). From the Great Black-backed Gull

b). From the Curlew

c). From the Herring Gull


22.
a.
b.
c.

0.015 - 0.0165 mm. wide at the base. The body spines in the post-acetabular region are up to 0.03 mm. long with a base of 0.006 - 0.007 mm., are sparsely scattered and extend to approximately 0.23 mm. beyond the ventral sucker.

The overall body length is (a) 2.25 mm., (b) 3.5 - 4.25 mm., (c) 5 - 6 mm. The length of the anterior portion (which reaches to approximately the posterior third of the ventral sucker) in the two contracted forms are (a) 0.82 mm., (c) 2.25 mm. The body diameter varies greatly in the different forms (a) and (c), while in (b) it is fairly constant. The respective collar diameters are (a) 0.504 mm., (b) 0.602 - 0.77 mm., (c) 0.804 - 0.98 mm. The anterior portion (measured at the base of the pyramid, across the ventral sucker) is (a) 0.91 mm., (b) 1.12 - 1.194 mm., (c) 1.78 - 1.784 mm. The diameter across the posterior portion is (a) 1.14 mm., (b) 1.12 - 1.55 mm., (c) 2.866 - 2.906mm.

The oral sucker is oval, muscular and terminal, and shows variation in the different forms appropriate to the respective sizes. In (a) it is 0.212 mm. long and 0.284 mm. wide, in (b) it is between 0.284 - 0.346 mm. long and 0.332 - 0.456 mm. wide and in (c) it is 0.54 - 0.56 mm. long and 0.56 - 0.587 mm. wide. The ventral sucker is found in the anterior half of the body and is very muscular. In (a) it is 0.504 mm. long and 0.515 mm. wide, in (b) it is 0.728 - 0.8 mm. long and 0.74 - 0.896 mm. wide, and in (c) it is 0.99 - 1.036 mm. long and 1.064 - 1.108mm. wide.

Internal Morphology

a) Alimentary canal

A short prepharynx joins the oral sucker to the muscular pharynx. It can be everted into the oral sucker as is found in (a) and (b) and as is shown in Figure 21. In (c) it reaches a length of 0.132 mm. and is very voluminous, up to 0.1 mm. wide. The muscular pharynx is (a) 1.48 mm. long and 0.115 mm. wide (wall thickness, 0.049 mm.), (b) 0.17 - 0.212 mm. long and 0.156 mm. wide (wall thickness, 0.04- 0.066 mm.), (c) 0.23 - 0.3 mm. long and 0.24 - 0.249 mm. wide, (wall thickness, 0.076mm.). The oesophagus also shows great variation in length up to its bifurcation, (a) 0.142 mm., (b) 0.284 - 0.412 mm., (c) 0.56 mm. The bifurcation precedes the ventral sucker by (a) 0.042 mm., (b) 0.07 mm., (c) 0.142 - 0.24 mm. The caeca extend round the testes as is shown in Figure 21 and are dilated at their termination.

b) Musculature

Sectioning showed the usual body wall structure of a cuticle 0.005 - 0.007 mm. thick overlying a circular muscle layer (one fibre thick), a longitudinal layer (one to two fibres thick) and an oblique layer (one fibre thick). As is to be expected the greatest concentration of muscles is in the head and pre-acetabular region.

c) Excretory system

The excretory vesicle is of a most irregular shape with a subterminal, dorsal pore. It is wider than long with

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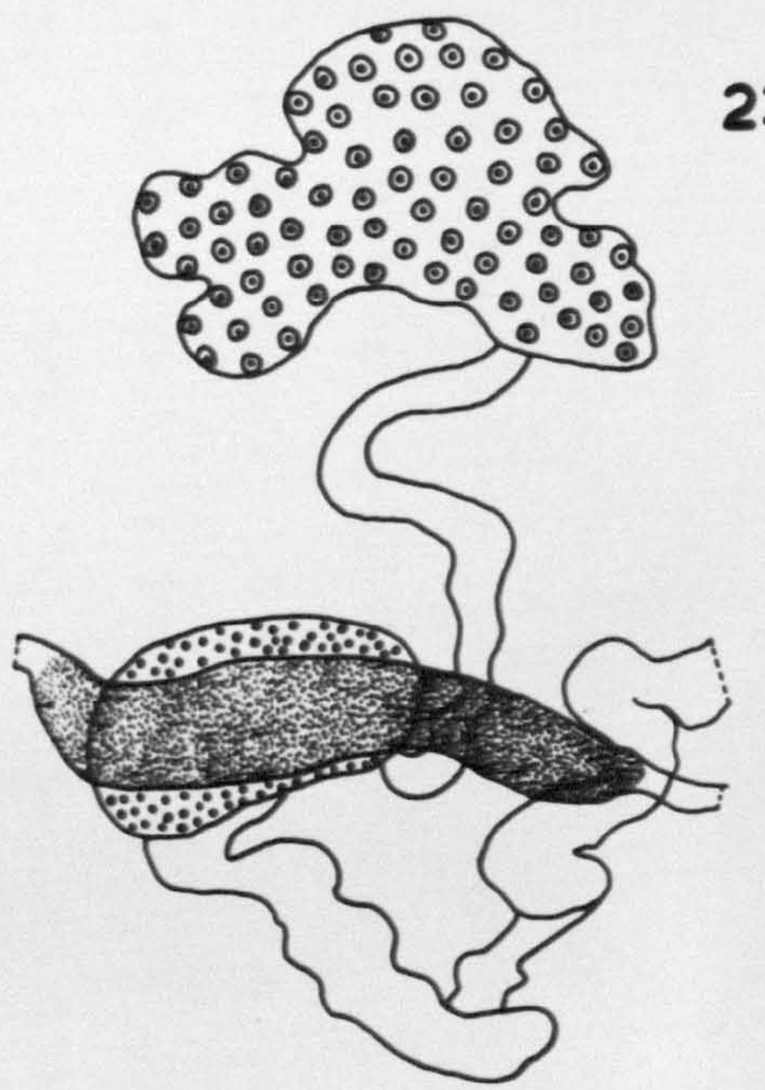
Plate 15

Parorchis pittacium (Braun, 1900)

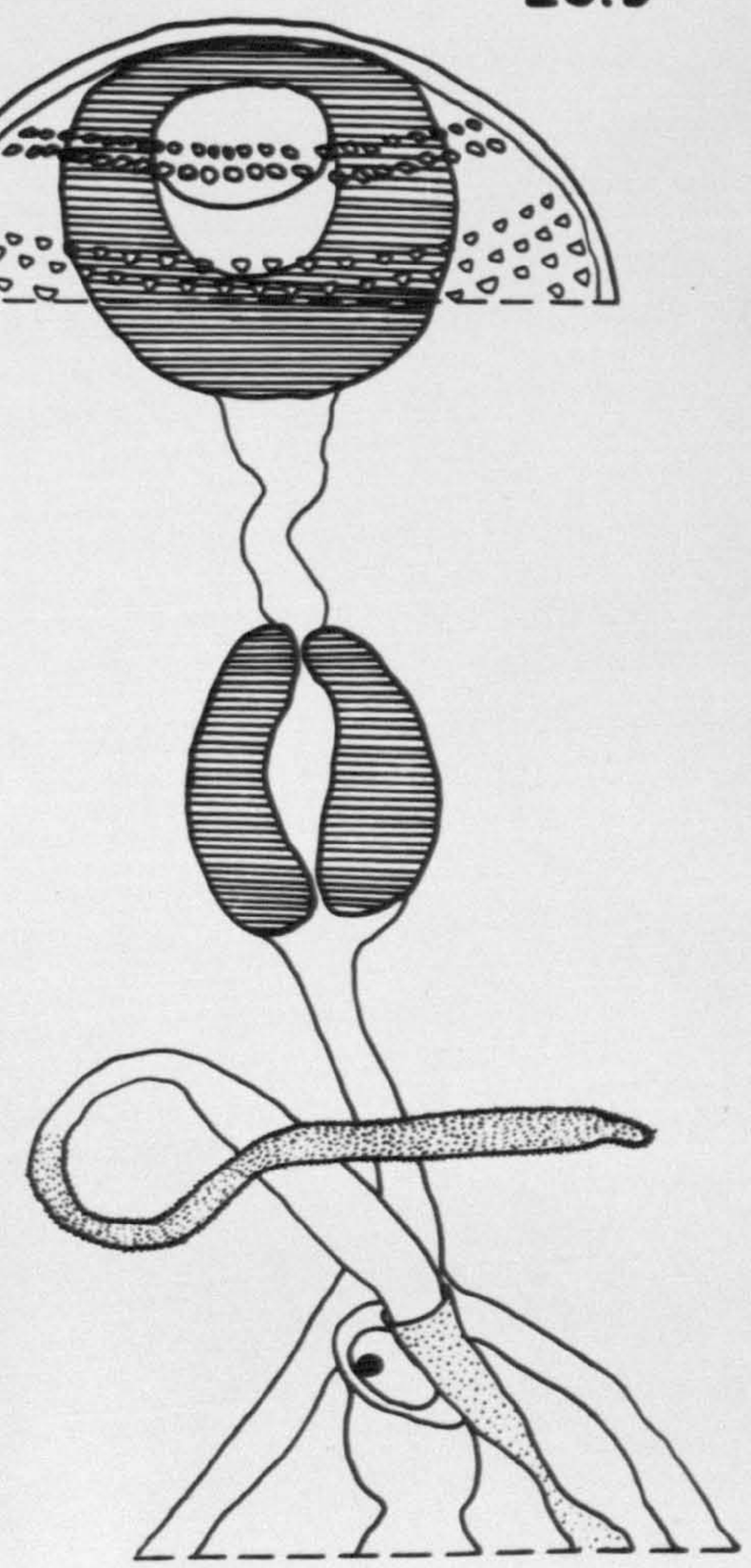
Figure 23a. Female reproductive system.

Echinostephilla virgula Lebour, 1909

Figure 23b. Head and cirrus.



23. a



23.b

wide. Particular mention must be made of (b) where the ovary is distinctly lobed (Figures 22b and 23a) in contrast to the uniform roundness of (a) and (c). In (b) it is 0.142 mm. from the testes but in (c) only 0.1 mm. In (a) the distance is obscured by the mass of ova.

The oviduct arises from the ovicapt on the postero-dorsal side of the ovary and passes dorsally to meet Laurer's canal before turning sharply in a ventral direction to join Mehlis' gland. This is a glandular mass 0.132 mm. long and 0.063 mm. wide. Directly dorsal to it is the yolk reservoir 0.198 mm. long and 0.049 mm. wide. From Mehlis' gland the uterus emerges on the dorsal side and turns posteriorly to follow a convoluted course as the 'receptaculum uterinum' with a diameter of 0.03 mm. This is illustrated in Figure 23a , which is drawn from the ventral side so that the dorsal ovicapt, Laurer's canal and the emergence of the uterus from Mehlis' gland cannot be seen.

The uterus is much convoluted in this area and in most specimens turns to loop between the testes and back and forth between the testes and ovary. It passes forwards on an irregular course, overlapping the caeca on each side. It straightens out in the region of the ventral sucker, which it passes on the dorsal side as the thick-walled metraterm. The genital atrium is contained in a laterally extended hollow, the ridges of which separate it from both the ventral sucker and the pre-acetabular region. An attempt to illustrate this is contained in Figure 21.

The yolk glands are found surrounding the caeca on each side, between the posterior of the ventral sucker and the anterior level of the testes. They are about 0.04 mm. in diameter and more sparsely scattered in (b) than in (a) and (c).

The thick-shelled eggs vary between 0.082 mm. and 0.086 mm. long and 0.043 - 0.046 mm. broad, which is smaller than those of Nicoll. The eye-spot of the developed miracidia can be seen for most of the uterus length.

Discussion

With the exception of Rees's excellent and detailed account of the reproductive system, this is the first redescription of Parorchis pittacium (Braun, 1901) Nicoll, 1907, from a British host since Nicoll's original description for Parorchis acanthus (Nicoll, 1906) Nicoll, 1907. Table 15 shows Nicoll's original measurements and those of the three host-forms described above. It will be seen that the measurements for the Herring Gull (Column 5) agree well with those of Nicoll.

Since Nicoll's description of P. acanthus, there have been several other species added to the genus. Linton (1914) described P. avitus from the Herring Gull at Woods Hole, Massachusetts, which differed from P. acanthus in the extent of the uterine coils and sucker ratios in the adult stages. Stunkard and Cable (1932) confirmed this as a valid species, but Cable and Martin (1937) submitted that it should be recognised as a synonym for P. acanthus. Travassos (1918) described P. proctobium from the Night Heron (Nyctanassa violacea) in

TABLE: 15 Parorchis nittacium (Braun, 1901), Nicoll, 1907 b.

Characters	Nicoll 1906-1907	Great Black Back Gull	Curlew	Herring Gull
Length	3.0 - 5.0	2.25	3.5 - 4.25	5.0 - 6.0
" anterior	⅓	0.82	" -	2.25
" posterior	⅔	1.43	-	3.25
Diameter collar	0.82 - 0.87	0.504	0.602 - 0.77	0.84 - 0.98
" anterior	1.2 - 1.6	0.91	1.105 - 1.194	1.78 - 1.784
" posterior	2.11	1.4	1.12 - 1.55	2.866 - 1.906
Oral Sucker	0.5	0.212 x 0.284	0.284 - 0.34 x 0.332 - 0.456	0.54 - 0.56 x 0.56 - 0.582
Prepharynx	0.11	everted	everted	0.13 x 0.1
Pharynx	0.24 x 0.17	1.48 - 0.115	0.17 - 0.212 x 0.156	0.23 - 0.3 x 0.24 - 0.249
Oesophagus	0.72	0.142	0.284 - 0.428	0.56
Ventral Sucker	1.08	0.504 x 0.515	0.728 - 0.8	0.99 - 1.036
Spines				
Cephalic	0.037	0.033	0.029 - 0.037	0.031 - 0.033
Body (ant.)	0.019	0.022	0.016 - 0.018	0.021
(post.)	0.031			0.027 - 0.03
Testes	0.55 - 0.6	0.2	0.284 - 0.388	0.714 - 0.798
External Seminal Vesicle	-	-	-	0.115 - 0.132 x 0.037 - 0.04
Ovary	0.33 x 0.25	0.148	0.181	0.226 - 0.26 x 0.312 - 0.388
Mehlis' gland	-	0.132	-	0.1 x 0.08
Receptaculum seminis	-	0.066	-	0.06 x 0.148
Eggs	0.081 - 0.106 x 0.04 - 0.062	0.082 x 0.046	0.079 x 0.046	0.082 - 0.086 x 0.043 - 0.046

Brazil and Skrjabin (1924) P. gedoelsti from the Dunlin (Calidris alpina (L.)) and the Sanderling (Crocethia alba (L.)) in Russia. Strom (1927) added P. asiaticus from the Gull-billed Tern (Gelochelidon nilotica) in Turkestan and Lal (1936) P. snipis from the Common Sandpiper (Tringa hypoleucos (L.)) in India.

Russell (1958), in a paper read to the American Society of Parasitologists as a result of the examination of eighty-three species from five different hosts, reduced all the above mentioned species into synonymy with P. pittacium (Braun, 1901) Nicoll, 1907. The above species-descriptions have been read by the writer and from the literature one is obliged to conclude that Russel is correct.

For example, Lal in his description of P. snipis placed great emphasis on the small number of yolk follicles and the four larger pairs of spines found laterally on the collar. Comparison with the writer's specimens from the Curlew shows that the yolk follicles are equally few and evenly distributed, while the uterine coils are mainly intercaecal. The curlew forms do have larger lateral cephalic spines but this is true of seven to eight lateral pairs not merely four. He further differentiates P. snipis from both avitus and acanthus on:

a) the pre-testicular position of the receptaculum seminis, (Lal Figure 3 p.30, shows the receptaculum seminis at the point in the oviduct where Rees (1939) and the writer indicate the junction with Laurer's canal. Since Rees and the writer accept the storage of sperms in a receptaculum uterinum it is possible that

Lal has misinterpreted the junction of Laurer's canal and the oviduct)

b) the lateral cirrus sac, (while all accounts agree that the cirrus opening is in the genital atrium in the midline, the body of the cirrus must be to the right of the midline, since the metraterm occupies the space to the left)

c) a separate male and female opening into the genital atrium, (this is not unusual and Rees's account is in agreement)

d) limitation of the vesicula seminalis behind the ventral sucker, (Rees states that it extends over the ventral sucker and the writer's specimens show both variations - this is obviously relative to the amount of flattening to which the worm has been subjected.)

e) the weak, ridge-like collar projection (this is dependent on the amount of relaxation of the anterior end at the time of fixation - the Herring Gull specimens, Figure 22 (c) and Nicoll, 1907 b show this condition more than adequately).

The ova measurements are smaller than those recorded by other workers but the scattered sparsity of ova shown in Lal's Figure I suggests that his ova may not have been fully mature. Apart from the receptaculum seminis all these characters are found in the variation of forms and sizes described in the text above. In fact a morphological character of as much significance as any of those described by Lal is the lobed nature of the ovary in the Curlew forms (Figures 22 (b) and 23 (a)). One is loathe to create a new species on this detail.

With P. pittacium (Braun, 1901) Nicoll, 1907 as the only species in the genus, the problem of classification remains. Dubois and Mahon (1958) accepted the synonymy and placed it, together with Singhiatrema Simha, 1954, into the family Ommatobrephidae on the basis of adult morphology. Lumsden and Zischke (1963) point out that the cercaria is obviously related to the Philophthalmids. Yamaguti (1958) had already assigned Parorchis to the Philophthalmidae in a subfamily Parorchiinae which he amended from Lal's Parorchinae.

The writer has accepted Yamaguti's classification and Russel's synonymy.

The Curlew (Numenius arquatus L.) is a new host record.

Family: PHILOPHTHALMIDAE Travassos, 1918

S.F.: Echinostephillinae Yamaguti, 1958

Syn.: Skrjabinovermiinae Yamaguti, 1958

Genus: Echinostephilla Lebour, 1909

12) Echinostephilla virgula, Lebour, 1909

Syn.: Skrjabinovermis vesiculata Belopolskaya 1953

Echinostephilla virgula was first described from the mid-intestinal region of the Turnstone (Arenaria interpres L.) obtained on the Northumberland coast by Lebour, 1909. It was placed in the subfamily Echinostominae Looss, 1899. No other records have been traced until Shelswell's redescription (1954)

based on material from the Turnstone at St. Andrews. The first record for Wales is that of Williams (1962) from the Gower Peninsula. The following description is based on a single complete and a second half-specimen taken from the intestine of a Turnstone at Monkstone Point, Saundersfoot, Pembrokeshire, in November, 1962.

External Morphology

The body is elongate, measuring 7 mm. (Figure 24). It is rounded anteriorly and pointed posteriorly, and before flattening and mounting the specimens, a distinct concave widening of the body between the two suckers was observed, (Figure 25). This is the broadest part of the body (0.98 mm.) which then narrows sharply behind the ventral sucker. The convex dorsal surface and concave ventral surface were noted.

The oral sucker is sub-terminal, ventrally directed and comparatively small (0.148 mm.) while the ventral sucker has a diameter three times as large (0.445 mm.) and occupies most of the body width at a point roughly one-sixth of a body-length from the anterior end. In Shelswell's specimens the ventral sucker diameter was four times that of the oral.

The anterior end of the body is unarmed, but a double row of head spines may be found on the dorsal surface only at a distance of 0.05 mm. from the tip, (Figure 23 (b)). These spines are blunt and triangular, measuring 0.007 mm. long and 0.009 mm. at the base. There are approximately fifty in each row which are arranged in opposing pairs not alternately as stated by

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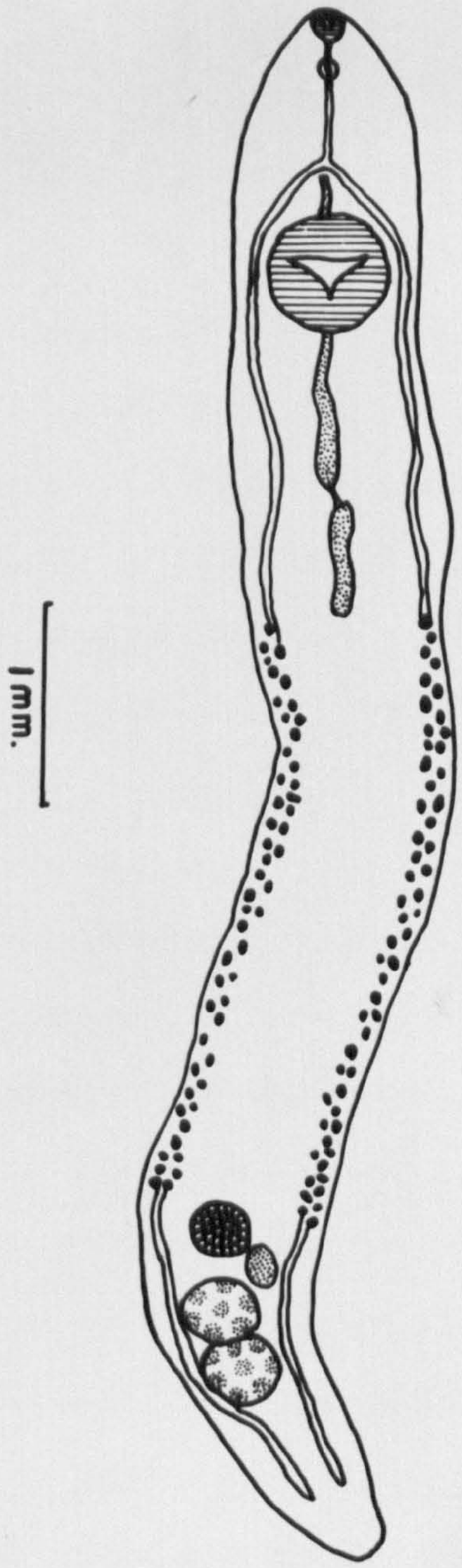
Plate 16

Echinostephilla virgula Lebour, 1909

Figure 24. Complete specimen.

Figure 25. Head. L.P. X 10.

24.



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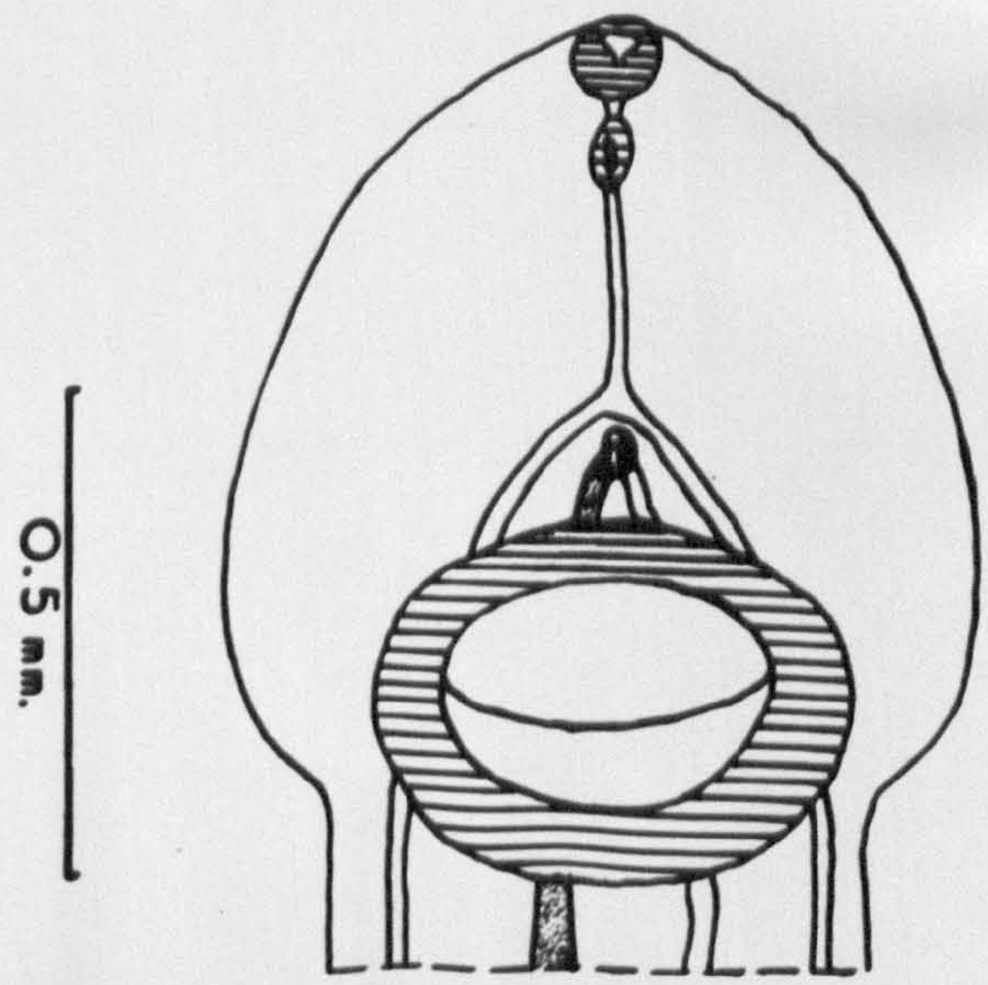

Shelswell. A further 0.036 mm. along the body are found the first row of body spines. These are small and closely crowded in the anterior region and are the same size as the head spines initially. The alternating rows continue down the body and cease 0.3 mm. behind the posterior testis. In this region they attain a size of 0.014 mm. long and 0.009 mm. at the base, are triangular and more pointed. Each row is 0.025 mm. apart in the posterior quarter of the body. Lebour's specimens had rows 0.02 mm. apart in this region.

Internal Morphology

a) Alimentary canal

The prepharynx is 0.088 mm. long and enters a prominent, muscular pharynx (0.123 mm. long and 0.096 mm. broad) from which the oesophagus arises and continues for 0.374 mm. prior to bifurcation some two-thirds of the distance between the two suckers. The unbranched caeca continue along each side of the body, where they tend to be obscured by the vitellaria, and terminate at a distance of 0.256 mm. from the posterior end. Their diameter varies between 0.036 mm. and 0.05 mm.

b) Musculature

The shortage of material did not make it feasible to prepare any sections.

c) Excretory system

The bladder is an irregularly shaped vesicle found between the ends of the caeca and the posterior tip. It opens by a terminal pore. The two longitudinal collecting ducts open at

its anterior end. It extends to the posterior testis and possibly a little beyond..

d) Reproductive system - Male

The testes lie in tandem in the posterior quarter of the body. Their diameter is slightly larger than their length and in the single complete specimen obtained, their adjacent surfaces were touching, (Figure 24). The anterior testis measures 0.27 mm long and 0.312 mm. broad, while the posterior testis is slightly larger, measuring 0.332 mm. long and 0.346 mm. broad. The distance from the posterior tip of the body is 0.756 mm. The vas deferens runs forwards and expands to form the external seminal vesicle (0.53 mm. long and 0.08 mm. wide). A narrow duct continues to enter the cirrus sac, which is 1.53 mm. long. The internal seminal vesicle occupies the posterior 0.428 mm. of the sac, which itself extends for 0.77 mm. behind the ventral sucker. The pars prostatica is 0.3 mm. long. In the complete specimen the cirrus is inverted and the spined tip may be seen extending behind the ventral sucker. This has made it possible to measure the cirrus length (0.856 mm.), which neither Lebour nor Shelswell mentions. The cirrus sac enters the genital atrium which is immediately posterior to the intestinal bifurcation and is 0.256 mm. in front of the anterior border of the ventral sucker.

The cirrus is everted in the second (incomplete specimen) and the fine, backwardly directed spines are found to occur up to 0.198 mm. from the tip (Figure 23 (b)). Their length is only 0.002 - 0.003 mm. The opening of the cirrus sac within the

genital atrium is anterior, dorsal and slightly to the right of the uterus opening.

e) Reproductive system - Female

The ovary is subspherical and in contrast to Shelswell's description is found to be broader (0.28 mm.) than long (0.18 mm.) This is in agreement with Lebour's description. It is anterior to the testes and separated from them by a distance of 0.181 mm. The vitellaria are found in lateral extension from the posterior end of the external seminal vesicle to the anterior end of the ovary. In Lebour's specimens the vitellaria extend to the posterior testis. The vitelline ducts unite to form a small reservoir posterior and dorsal to the ovary.

Neither Lebour nor Shelswell make any mention of Mehlis' gland. The single complete specimen shows a faintly-stained rounded body (0.14 mm. in diameter) on the left side of the midline between the ovary and the anterior testis. While it does not appear to be glandular, the position and presence of very immature ova suggest that this is the previously undescribed Mehlis' gland (Figure 24). The uterus comprises a short descending limb which is ventral to the anterior testis and turns abruptly to take a convoluted ascending course before straightening, just behind the ventral sucker, to open, alongside the cirrus sac, into the genital atrium.

The ova in the fixed specimens attain a maximum length of 0.08 mm. and breadth of 0.024 mm. Many empty eggs are found in the region prior to the ventral sucker, the miricidia living free in utero.

TABLE: 16 Echinostephilla virgula Lebour, 1909

Characters	Lebour, 1909	Shelswell, 1954	Author
Length	4.0 - 8.0	5.8 - 7.2	7.0
Breadth	0.6	0.65 - 0.93	0.98
Head Spines	0.008	0.006 x 0.008	0.007 x 0.009
Body Spines	0.01	0.005 - 0.013 X 0.006 - 0.011	0.012 - 0.014 X 0.009
Distance between	0.02	0.026	0.036
Oral Sucker	0.12	0.111 - 0.145	0.148
Prepharynx	0.1	0.033 - 0.051	0.088
Pharynx	-	0.088 - 0.121 X 0.055 - 0.101	0.105 - 0.123 X 0.093 - 0.096
Oesophagus	0.3	0.196 - 0.311	0.226 - 0.374
Caeca - distance from body end	0.6	0.24 - 0.383	0.256
Ventral Sucker	0.4	0.437 - 0.6	0.445 - 0.504
Testes	0.2 - 0.24	0.186 - 0.284 X 0.207 - 0.295	0.27 - 0.312 X 0.332 - 0.346
Distance from body end	-	0.568 - 0.98	0.756
External Seminal Vesicle	-	0.459 - 0.6	0.53
Cirrus sac	-	-	1.53
" " extent behind ventral sucker	0.6	0.502 - 0.678	0.77
Ovary	similar to testes	0.198 - 0.254 X 0.196 - 0.23	0.18 x 0.28
Distance from ant. testis	0.12	0.142 - 0.24	0.181
Yolk follicle	-	0.04 - 0.06	0.069 - 0.08
Eggs	0.1 - 0.05	0.066 - 0.081 X 0.026 - 0.044	0.069 - 0.08 X 0.034 - 0.038

Discussion

The measurements of the description above are tabulated together with those of Lebour and Shelswell in Table 16. It will be observed that most of the additional measurements are within the range given by these two authors - with the exception of the distance between head and body spines, the oral sucker diameter, body diameter, the prepharynx and oesophagus lengths and the overall measurements for the pharynx, testes and ovary, all of which are larger. Only the egg measurements are smaller than those recorded by previous authors and Lebour's caeca fall markedly short of the body end - 0.6 mm. as opposed to 0.307 mm. (Shelswell) and 0.256 mm. (Elce).

Details of the pars prostatica, cirrus length and spination are given for the first time. Lebour (1909) states that she never saw the cirrus spines everted and concluded that the spines serve to prevent the sperm re-entering the body of the cirrus. The writer's specimens illustrate quite clearly that the cirrus spines are everted with the rest of the cirrus. The 'neck' which Lebour describes and illustrates in the region between the head spines and the first row of body spines has not been observed by Shelswell or the present writer.

Mehlis' gland is described for the first time.

Lebour placed the genus in Echinostominae Looss, 1899 (now Echinostomatinae, Faust, 1929), but pointed out that it differs from all previous genera in having miricidia in the eggs and weakly developed vitellaria. She compared it with <u>Parorchis</u>

acanthus (Nicoll, 1906) and suggested that the presence of the miracidia might place the genus in Philophthalminae Looss, 1899. Nicoll (1923) listed the species in sub-family 'Paraechinostominae (i.e. unclassified echinostomes). Dawes (1946) included it together with Parorchis acanthus (Nicoll, 1906) in 'isolated genera' of the Echinostomatidae. Shelswell (1954) discussed both genera and suggested that Echinostephilla should be placed in Philophthalmidae Travassos, 1918. Yamaguti (1958) has followed this suggestion and created the new sub-family Echinostephillinae to incorporate this species. It is to be noted that in his key to the sub-families (p.672), he states 'vesicula seminalis externa absent'. Its presence was first described by Shelswell, whose paper he quotes on page 672, and is confirmed by this writer. He also states 'no pars prostatica observed' - this has been described above.

Lebour found this species in three out of twelve Turnstones but does not state the worm burden or time of year. Shelswell mentions it as a frequent find between September 1949 and March 1951, with a worm burden of fifty to one hundred per host. She ceased to find it after this period. William's records are from one of two birds shot in January 1955, but he does not give the worm burden.

Of the nine Turnstones examined by the writer at various times of the year, only a single bird shot in November 1962 was infested with two specimens. Turnstones have been obtained from both the sandstone and limestone areas of the coast but neither

habitat yielded an infestation and so may be considered not to support the intermediate host. It should be pointed out that Monkstone Point is at the opposite side of Carmarthen Bay from William's source of material, so that migration from an area where infection is possible is the most probable solution to this isolated occurence of the trematode.

Ching (1960) has described a second species, E. haematopi in Haematopus bachmani from Washington. He suggests that Skrjabinovermis vesiculata Belopolskaya, 1953, is a synonym of E. virgula, on the grounds of identical hosts, body-shape and measurements of body, organs and eggs. Yamaguti (1958) has included it in the Philophthalmidae as a new sub-family, Skrjabinovermiinae, and examination of his diagnostic characters for the new sub-families Echinostephillinae and Skrjabinovermiinae and their respective species reveals only one character in Skrjabinovermis that has not yet been described in Echinostephilla, namely the possession of a receptaculum seminis. That the Echinostephillinae cannot be distinguished from Skrjabinovermiinae on the absence of the external seminal vesicle as in Yamaguti's key has been mentioned above. The statement 'pars prostatica not observed' for Echinostephillinae, and 'well differentiated pars prostatica' for Skrjabinovermiinae is now disproven since the pars prostatica is described in this text. The presence of the Mehlis' gland has not previously been observed in Echinostephilla and it is possible that the receptaculum seminis awaits identification. Had there been sufficient material for

the writer to make serial sections, then its presence or absence would have been confirmed. The writer proposes that with the additional evidence available from this text, Ching's suggested synonymy can be adopted.

Nicoll (1923) observed that Echinostephilla virgula Lebour, 1909, is the only trematode that is exclusive to Britain. Even accepting the above-maintained synonymy, there has been only this one external record and no new host records. This is altogether astonishing when it is remembered that the Turnstone is mainly a winter visitor and passage migrant with a breeding range from Greenland to Siberia and south to the Baltic. It winters south to South Africa and Australia! (A few breeding pairs may be found, however.) The specimens were found with a far heavier burden of Paraplonocephalum symmetricum which Belopolskaya in 1952 described from the Purple Sandpiper (Calidris maritima Brünnich) in Siberia.

The implication is that the bird shot bred in Siberia and, on entering British waters to winter, had acquired the additional small infection of Echinostephilla virgula Lebour. The occurence of E. virgula (ex Skrjabinovermis vesiculata) in Siberia is the result of migration in the reverse direction.

An intermediate host which may prove to be exclusive to the British coastline offers a promise of a not uninteresting life-cycle for British helminthology.

Family: PRONOCEPHALIDAE Looss, 1902

S.F.: Pronocephalinae Looss, 1899

Genus: Parapronocephalum Belopolskaya, 1952

13). Parapronocephalum symmetricum Belopolskaya, 1952

The family Pronocephalidae contains trematodes found chiefly in the turtles and rarely in fish. The only representative from birds is Parapronocephalum symmetricum Belopolskaya, 1952, which was found in the liver of the Purple Sandpiper (Calidris maritima Brünnich) in Siberia.

There were three and a half specimens found together with Echinostephilla virgula Lebour, 1909, in the small intestine of the Turnstone (Arenaria interpres L.) shot at Monkstone Point, Saundersfoot, Pembrokeshire in November 1962.

External Morphology

Belopolskaya's measurements are given in brackets.

The trematode is elongate with rounded extremities, 4.1 - 6mm. long (6.0 - 6.5 mm.) and 0.84 - 1.2 mm. wide (1.3 - 1.6 mm.) at the region of the vitellaria (Figure 26). The head end is surrounded by a muscular but incomplete collar, 0.56 - 0.784 mm. (0.76 - 1.1 mm.) in diameter. The oral sucker is oval, 0.47 - 0.56 mm. (0.52 - 0.8 mm.) by 0. 28 - 0.374 mm. (0.4 - 0.44 mm.), with an opening 0.284 - 0.42 mm. There is no ventral sucker. The cuticle is thin and unarmed. Before staining and mounting, on the flattened ventral surface, three rows of glands were observed. They were not counted, unfortunately, and have not taken the stain.

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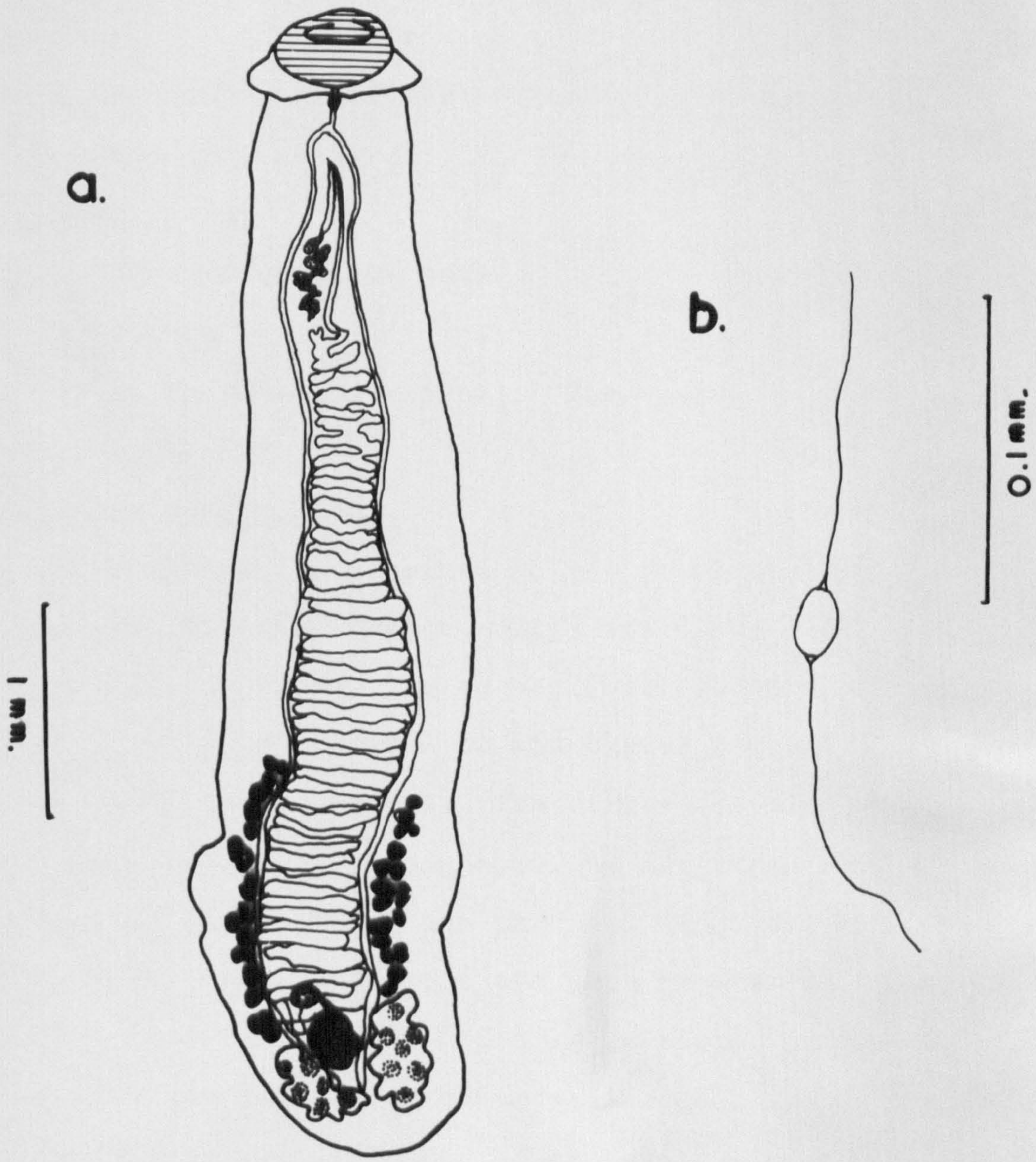
Plate 17

Paraplonocephalum symmetricum Belopolskaya, 1952.

Figure 26a. Complete specimen.

26b. Egg with polar filaments.

26



Internal Morphology

a) Alimentary canal

A short oesophagus, 0.1 - 0.156 mm. bifurcates into two lateral caeca which continue to within 0.55 mm. of the posterior end. The caeca are internal to the testes in the posterior region. There is no definite pharynx but a distinct dilation is seen, just posterior to the oral sucker.

b) Musculature

Serial sections were not made.

c) Excretory system

The excretory pore is terminal. The extent of the vesicle could not be discerned.

d) Reproductive system - Male

The lobed testes lie external to the caeca on each side of the body in the posterior region. They are 0.4 - 0.49 mm. long and 0.212 - 0.24 mm. wide. The vasa efferentia were not observed. The seminal vesicle is external to the cirrus sac and much coiled, from 0.28 - 0.353 mm. in extent. The cirrus sac is 0.212 - 0.346 mm. (0.28 - 0.38 mm.) long by 0.055 mm. wide. The cirrus is approximately 0.2 mm. long and unarmed. The ductus ejaculatorius is 0.06 mm. by 0.04 mm. but the pars prostatica cells were not seen. The genital atrium is poorly developed in the midline 0.13 mm. behind the intestinal bifurcation.

e) Reproductive system - Female

The ovary is found between the caeca in the posterior region. Unlike the testes it is not lobed, 0.312 - 0.326 mm. by 0.232 -

0.312 mm. Mehlis' gland lies anteriorly to the ovary in the midline or a little to the right. It is 0.148 - 0.165 mm. by 0.082 - 0.107 mm. The yolk ducts are 0.02 mm. in diameter and lead into a yolk reservoir, 0.14 mm. by 0.06 mm., which is ventral to Mehlis' gland. The uterus passes anteriorly in transverse loops which are mainly intercaecal, but later may overlap the caeca to some extent. The long metraterm (0.5 mm.) is 0.03 mm. wide and opens into the genital atrium to the left of the cirrus sac.

The vitellaria consist of large follicles 0.08 - 0.1 mm. in diameter which extend from 1.078 - 1.404 mm. in front of the testes, external to and overlapping the caeca.

The eggs are 0.019 mm. long and have polar filaments 0.1 mm. long. (Belopolskaya's eggs are 0.21 - 0.22mm. x 0.012 - 0.013mm.)

Discussion

There is approximate agreement between Belopolskaya's description and that given above. However, the caeca in the present collection pass within the testes and Belopolskaya's measurements are consistently if not significantly larger. Both writers note that the dermal glands are not demonstrable in carmine stains. Hamovy (1947) found P. symmetricum in a Turnstone at Kamdulaksh Game Reserve in the White Sea. This is the first record of the species in Europe and a new location for the trematode within the host.

Family: CYCLOCOELIIDAE Kossack, 1911

S.F.: Cyclocoeliinae Stossich, 1902

Genus: Cyclocoelum Brandes, 1892

Dubois, 1959, revised the family Cyclocoeliidae Kossack, 1911, to include only two sub-families, Cyclocoeliinae Stossich, 1902 and Typhlocoeliinae Harrah, 1922.

The two genera retained in the first sub-family were given the following synonyms:-

a). Cyclocoelum Brandes, 1892 - (Allopyge Johnston, 1913, Haematoprimus, Cycloprimum, Corpoprymum, Prohyptiasmus, Transcoelum all Witenberg, 1923, Uvitellina Witenberg, 1925, Wardianum, Harrahium both Witenberg, 1926, Stossichum, Morishitium both Witenberg, 1928, Pseudohyptiasmus Dollfus, 1948, and Szidatiella Yamaguti, 1958),

b). Ophthalmophagus Stossich, 1902 - (Spaniotrema Kossack, 1911, Promptenovum Witenberg, 1923, Contracoelum Witenberg, 1926, Bothrigaster and Geowitenbergia Dollfus, 1948).

The two genera retained in the second sub-family are:-

a). Typhylocoelum Stossich, 1902 - (Tracheophilus Skrjabin, 1913, Typhluktimum Witenberg, 1923 and Tryophilus Lal, 1936),

b). Neivaia Travassos, 1929.

After discussing the previous attempts at classification (Kossack, 1911, Harrah, 1922, Witenberg, 1923, 1926, Joyeux and Bear, 1927 and Dollfus, 1948), Dubois concludes: "une taxonomie aussi complexe n'est pas reflet de la similitude des formes qui y sont incluses". The criteria used by this investigator were

the situation of the genital pore (around the mouth, anterior, middle or posterior to the pharynx), the diameter of the pharynx, the position of the intestine in relation to the lateral sides of the body and the extent of the vitelline glands. He stressed that the egg dimensions are rarely variable enough to be included.

The genus Cyclocoelum Brandes, 1892, has three sub-genera; Cyclocoelum Witenberg, 1928, Haematrophus Stossich, 1902, and Hyptiasmus, Kossack, 1911.

Chatterji (1958) revised the family to include only one sub-family, Cyclocoelinae Stossich, 1902, with only two genera, Cyclocoelum and Typhlocoelum. He further subdivided both genera into three groups:-

a). Ovary distinctly pre-testicular,

b). Ovary distinctly post-testicular,

c). Ovary distinctly between the testes,

and each group into two sub-groups:-

i). Gonads forming three points of a triangle,

ii). Gonads always in a straight line.

He has made no attempt to apply this at specific level, so that the many species, according to this classification, remain. Apart from the unsatisfactory classification of so many sub-genera and further divisions purely on the arrangement of the genitalia, the writer feels that the more radical and detailed scheme of Dubois is both more thoughtful and more serviceable and has accepted this latter system.

Sub-genus Cyclocoelum Witenberg, 1928

14). Cyclocoelum (Cyclocoelum) mutabile (Zeder, 1800) Dubois, 1959

Syns. Monostoma mutabile Zeder, 1800
Monostomum microstomum Creplin, 1829
Cephalogonimus ovatus Stossich, 1896
Cyclocoelum pseudomicrostomum Harrah, 1922
Cyclocoelum goliath Witenberg, 1923
Cyclocoelum paradoxum del Pont, 1926
Cyclocoelum japonicum Kurisu, 1932
Cyclocoelum microcotyleum Noble, 1933
Cyclocoelum lahillei Dollfus, 1948

Dubois' characters for the sub-genus are: ovary at the summit of a triangle, the base of which joins the two testes, the uterine loops are transversely orientated with a strong or generalized inflexion towards the posterior and entirely contained within the intestine, or may overlap slightly but do not extend beyond it.

Zeder (1800) described Distoma mutabile from the air-sacs of the Moorhen (Gallinula chloropus L.) in Germany. The species was recorded on several occasions throughout the remainder of the century, but it was not until 1892 that Brandes created the genus Cyclocoelum, with mutabile as type. Dubois gives it as type for the sub-genus Cyclocoelum Witenberg, 1928. It has been recorded from the Moorhen in Germany, Belgium, Italy, Turkestan, Japan, France, Poland and Switzerland, from the American Moorhen (Gallinula chloropus galeata (Licht.)) in Buenos Aires, from the Indian Moorhen (Gallinula chloropus indica Blyth) in Japan,

from (Gallinula chloropus cercis Bangs) in Cuba, from the Coot (Fulica atra L.) in Germany, Sweden, Turkestan, Armenia, Russia and Czechoslovakia, from the American Coot (Fulica atra americana Gmelin) in the United States and Mexico, from the Red-Gartered Coot (Fulica armillata, Vieillot) in South America and from the Martinique Gallinule (Porphyrula martinica (L.)) in Venezuela. These are all Ralliform hosts. The few Charadriiform hosts are Mexican Jacana (Jacana spinosa gymnostoma (Wagler)) in Mexico, Greenshank (Tringa nebularia (Gunn.)) in Turkestan and the Lapwing (Vanellus vanellus L.) in Siberia.

There are no previous British records, those of Nicoll (1923) being taken from Continental lists.

Three specimens were obtained from the air-sacs of a Moorhen from Cresswell Quay, Pembrokeshire in November, 1961, and one from the air-sacs of a Coot, also from Cresswell Quay in January, 1962.

External Morphology

The trematodes are 12 - 16 mm. long and before staining had a deep yellow coloration. The body diameter varies from 3 mm. to 4.35 mm. The cuticle is thick (0.056 mm.) and unarmed. There are no suckers, the stomum opening terminally or slightly subterminally (Figure 27).

Internal Morphology

a) Alimentary canal

The stomum is 0.073 - 0.09 mm. wide and leads into a prepharynx which is 0.428 - 0.63 mm. long. The large muscular

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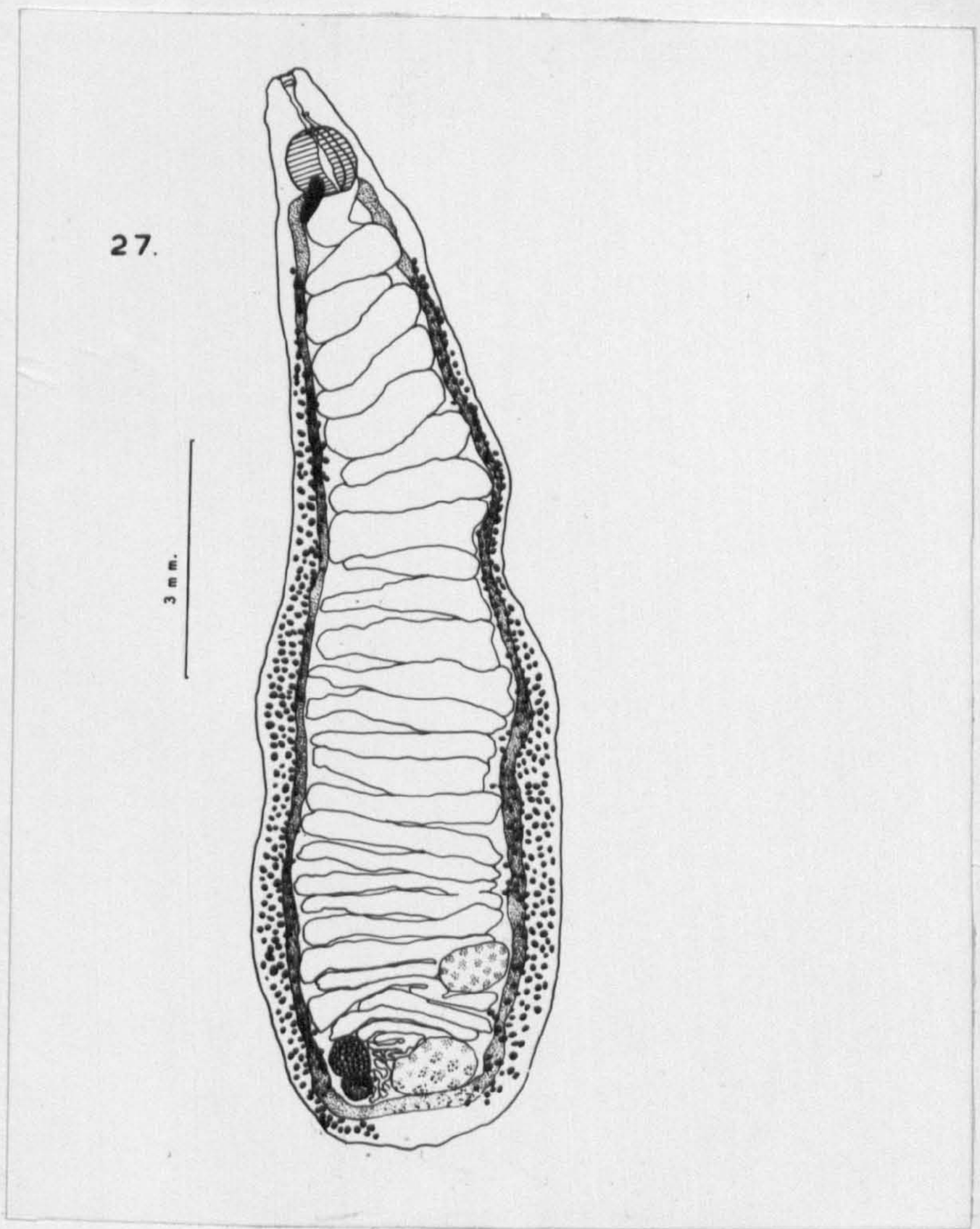
Plate 18

Cyclocoelum (C.) mutabile (Zeder, 1800)

Figure 27. Complete specimen.


27.
3 mm.

pharynx is perfectly round, the diameter varying from 0.728 - 0.98 mm. and the wall thickness from 0.326 mm. to 0.48 mm. The short oesophagus rarely exceeds 0.15 mm. and bifurcates to form a pair of caeca which are united posteriorly and enclose the genital organs and the uterus. Its average diameter is 0.25 mm. and in two of the four specimens some of the ova have become ingested and are found actually in the caecum at each side.

b) Musculature

Serial sections were not made.

c) Excretory system

The vesicle has a terminal or subterminal pore. It is found as an irregular, transversely flattened sac at the posterior end of the body outside the intestine.

d) Reproductive system - Male

The anterior testis is situated on the right hand side of the body. There was considerable variation in size in the four specimens, from 0.56 - 1.112 mm. long and 0.602 - 1.148 mm. wide. In the smaller and median size specimens it is oval but in the largest specimen it has six lobes. The posterior testis is found in the midline, adjacent to the caecum. It is smooth and considerably wider than long (0.35 - 0.7 mm. by 0.077 - 1.05 mm.). The distance between the testes is 0.49 - 0.78 mm. The vas efferens and vas deferens could not be traced within the uterus mass. The cirrus sac is found to the left of the midline, adjacent to the oesophagus. It is thick-walled and bulb-shaped, 0.156 - 0.17 mm. wide and 0.346 - 0.518 mm. long. The greatest

diameter is found in the posterior region across the interior seminal vesicle. An external seminal vesicle is absent. The cirrus was not found everted but within the cirrus sac was seen to lack spines. It opens a little to the left of the midline, immediately behind the pharynx.

e) Reproductive system - Female

The ovary is on the left of the midline of the body, adjacent to the caecum. It is circular and measures 0.35 - 0.49 mm. in diameter, that is less than half the size of the testes. Directly posterior to it is Mehlis' gland, which in some specimens is rather longer than broad, 0.35 mm. by 0.284 mm. The yolk reservoir is dorsal to Mehlis' gland and situated between it and the ovary. It is twice as long as broad, 0.215 mm. by 0.095 mm. The yolk ducts leading into it are 0.04 mm. in diameter. The uterus turns posteriorly between Mehlis' gland and the posterior testis and then follows an anterior course, filling all the body cavity in wide loops which touch but do not extend beyond the caecum. It straightens out in the midline anteriorly and opens, ventral to the oesophagus in the midline, at a level with, and to the right of, the cirrus sac.

The vitellaria extend from the level of the oesophageal bifurcation anteriorly to behind the posterior testis. They do not converge in the posterior end of the body and the follicles have a diameter of 0.1 mm. on average.

The eggs are thick-walled, oval and are slightly larger than the measurements recorded by Sprehn (1932), being 0.114 mm. long

and 0.64 mm. wide. The eyespot of the developed mirdcidium can be seen from the midbody onwards.

Discussion

The description in this text agrees in all parts with Dubois' characters for the species.

This is the first record of Cyclocoelum (cyclocoelum) mutabile (Zeder, 1800), Dubois, 1959, from Britain. It was found in the Coot (Fulica atra L.) and the Moorhen (Gallinula chloropus L.)

Sub-genus Hyptiasmus Kossack, 1911.

15). Cyclocoelum (Hyptiasmus) elongatum Harrah, 1921

Syns. Cyclocoelum sharadi Bhalero, 1935
Cyclocoelum dumetellae Zeliff, 1943
Cyclocoelum Bivesiculatum Prudhoe, 1944
C. (Pseudohyptiasmus) dollfusi Timon-David, 1950
C. (Pseudohyptiasmus) sinhaldvipa Fernando, 1950
Morishitium dollfusi (Timon-David, 1950)
Yamaguti, 1958.

Dubois characterises his sub-genus as follows: ovary always inter-testicular, exactly or nearly exactly on a line joining the centres of the two testes and often approaching the posterior testis and even touching it. Certain forms have the genital atrium before the pharynx or even in the middle of the prepharynx, while others may have the genital atrium near the intestinal bifurcation. In C. (Hyptiasmus) elongatum it is found at the

posterior portion of the pharynx and the ovary deviates slightly from a line joining the two testes.

The species has been found in the following Passeriforms: the Chinese Blue Magpie (Cyanopica cyana cyana (Pall.)), the Chinese Blue Pie (Urocissa erythrorhyncha (Bodd.)) and the Blue Whistling Thrush (Myiophoneus caerulus eugenie Hume) in China, the Yellow-billed Magpie (Urocissa flavirostris cucullata Gould) in India, the Magpie (Pica pica (L.)) in France and in the Cat Bird (Dumetella carolinensis (L.)) in Pennsylvania. Additional host records are: Picciformes - the Brown-headed Ceylon Barbet (Megalaima z. zeylonica (Gmelin)) and Galliformes - the Ceylon Jungle Fowl (Gallus lafayetti Less.)

There are no previous British records for this species. There were three specimens in a bottle labelled "Magpie - Gut" which was deposited at the Central Veterinary Laboratories, Weybridge, by Mr. I. F. Keymer (now of this Department) who had collected the specimens as part of a survey from West Wales. The writer was able to examine some of this collection through the kindness of Mr. J. Rose, of the Parasitology Department at Weybridge. One of the specimens was sectioned and the remaining two were stained and mounted.

External Morphology

The specimens, which were in alcohol, had a deep red-brown coloration before staining. They are elongate-oval with the pharynx enclosed in a protuberance anteriorly (Figure 28). The length of the mounted specimens was 6.9 mm. and 8.1 mm.

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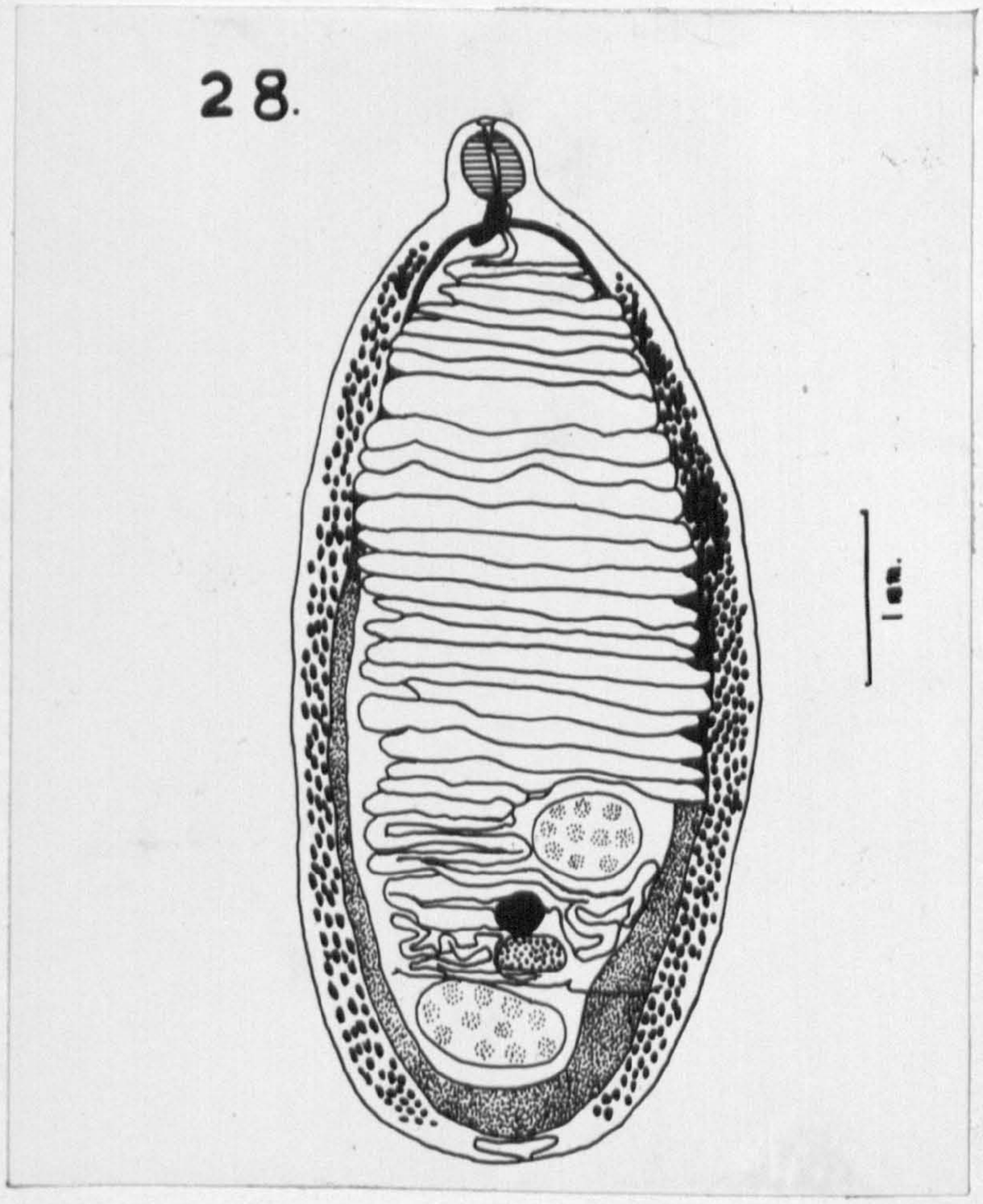
Plate 19

Cyclocoelum (Hyptiasmus) elongatum Harrah, 1923

Figure 28. Complete specimen.


28.
1 mm.

respectively, while the body width was 2.75 mm. and 3.2 mm.

The cuticle is thick and in transverse folds. Both suckers are absent.

Internal Morphology

a) Alimentary canal

The stomum is 0.085 - 0.1 mm. wide and leads into a short prepharynx, 0.07 - 0.1 mm. long. The muscular pharynx is slightly longer than wide, (0.266 - 0.27 mm. by 0.24 - 0.255 mm.) and the wall thickness is 0.08 mm. The short oesophagus, 0.15 mm., bifurcates into two caeca which are fused posteriorly.

b) Musculature

The cuticle is 0.028 mm. thick and beneath are found an outer layer of circular muscles (one fibre thick), an inner layer of longitudinal muscles (two to three fibres thick) and an innermost layer of oblique muscles (one to two fibres thick).

c) Excretory system

The elongate, flattened vesicle opens terminally. It is found in the midline, outside the intestine at the posterior end of the body. The two main excretory ducts are found on the external side and dorsal to the caecum on each side of the body.

d) Reproductive system - Male

The anterior testis is found to the right of the midline, 1.75 - 2 mm. from the posterior end of the body. It is oval, wider than long, 0.47 - 0.56 mm. by 0.616 - 0.7 mm. The posterior testis is found on the midline at the posterior end of the body within and adjacent to the caecum. It is again wider than long

(0.53 - 0.56 mm. by 0.82 - 0.938 mm.) and separated from the anterior testis by 0.77 - 0.84 mm. The cirrus sac is found to the right of the midline and is elongate-oval, (0.27 mm. long and 0.07 mm. wide). The seminal vesicle is 0.129 mm. long and proximal to this is the slightly larger pars prostatica. The external seminal vesicle is absent. The cirrus is not extruded but within the cirrus sac is seen to be unarmed.

e) Reproduction system - Female

The small ovary is in the midline and can only be observed in serial sections since it is obscured by the uterus. It is a spherical body, 0.29 - 0.33 mm. in diameter, to the right of a line joining the centre of the two testes. Behind the ovary is the well-developed Mehlis' gland which is transversely elongated, 0.35 mm. by 0.43 mm. The yolk ducts pass inwards between the posterior testis and Mehlis' gland (diameter 0.016 mm.). The uterus is much convoluted in this area and it proceeds anteriorly in loops which in the anterior half overlap the caecum on each side. The metraterm opens to the left of the midline at the same level as the cirrus sac. The genital aperture is in the midline, ventral to the oesophagus and directly behind the pharynx.

The vitellaria extend from the level of the bifurcation to the posterior end of the hindmost testis.

The eggs are 0.118 - 0.125 mm. long by 0.055 mm. wide.

TABLE: 17 Cyclocoelum (Hyptiasmus) elongatum Harrah, 1921

Characters	Timon-David, 1950	Author
Length	15.5 - 20.0	6.9 - 8.1
Breadth	2.9 - 4.0	2.75 - 3.2
Oral aperture	0.35	0.07 - 0.1
Pharynx	0.25	0.266 - 0.27 X 0.24 - 0.255
Oesophagus	0.25 -- 0.425	0.07 - 0.1
Anterior testis	0.91 - 1.35	0.47 - 0.56 X 0.616 - 0.7
Posterior testis	0.91 - 1.35	0.53 - 0.56 X 0.82 - 0.938
Cirrus sac	-	0.27 - 0.07
Ovary	0.32 - 0.4	0.29 - 0.33
Mehlis' gland	0.5 - 0.6	0.35 - 0.43
Eggs	0.12 - 0.13 X 0.058 - 0.06	0.118 - 0.125 X 0.055

Discussion

Except for the body length, the text above is in agreement with Dubois' characters for the species. In 1950, Timon-David described a species from the air-sacs of the Magpie (Pica pica (L.)) which he named Cyclocoelum (Pseudohyptiasmus) dollfusi. This has been synonymised with C. (Hyptiasmus) elongatum, Harrah, 1921, by Dubois. Timon-David's measurements are given together with those of the author in Table 17. The most notable difference is the body length. This must be accounted for by the location in the host. It is obvious that early in the worms' development they have been coughed up and swallowed by the host and even though this has not prevented development to maturity, it has affected the overall measurements. However, the two measurements counted as definitive by Dubois, namely the pharynx and the egg size are within the range for the species.

C. (Hyptiasmus) elongatum Harrah, 1921, has not been recorded from the British Isles.

Family: BRACHYLAEMIDAE Joyeux & Foley, 1930

Syn.: Harmostomidae Odhner, 1912

S.F.: Brachylaeminae Joyeux & Foley, 1930

Syns.: Heterolopinae Looss, 1899

Harmostominae Looss, 1900

Genus: Brachylaemus Dujardin, 1843

Syns.: Harmostomum Braun, 1899

Heterolope Looss, 1899

The genus Brachylaemus was erected by Dujardin (1843) with B. advena Dujardin, 1843 as type. Included in the genus were Distoma fuscatum and D. exasperata, both Rudolphi, 1819, D. mesostoma Rudolphi, 1803, and B. fulfus Dujardin, 1843. In 1845, Dujardin added B. arcuata, B. migrans (now type of the genus) and B. corrugata. The genus was slightly emended by Blanchard (1847) when he described B. erinacei, and was supressed by Braun (1902) into his own genus Harmostomum.

The genus was raised to family and sub-family status by Joyeux and Foley, 1930, who reduced the family Harmostomidae Odhner, 1912, into synonymy. The species of the genus, which are distributed between birds and mammals, are extremely difficult to separate, one of the principal attempts being Dollfus' (1934, 1935) who based his scheme on the hosts and zoo-geographic regions in which the trematodes are found. There appears to have been no major attempt to reassess the genus since Dollfus' scheme, Yamaguti (1958) merely listing all the known species and synonyms described from both birds and mammals.

16). Brachylaemus fuscatus (Rudolphi, 1819) Dujardin, 1843

Syns.: Distoma fuscatum Rudolphi, 1819
Distoma heteroclitum Molin, 1858
Harmostomum fuscatum (Rud., 1819) Braun, 1902
H. (Harmostomum) fuscatum Witenberg, 1925
H. pellucidum Werby, 1928

Distoma fuscatum was described by Rudolphi, 1819 from the intestine of the Quail (Coturnix coturnix (L.)) and from the Missel Thrush (Turdus viscivorus L.). It was transferred to the genus Brachylaemus by Dujardin (1843). Braun (1902) redescribed Rudolphi's original material and placed the species in his own genus Harmostomum. In particular, he mentioned the oral sucker being larger than the ventral. Witenberg (1925) described H. nicolli, in which the oral sucker is smaller than the ventral, but Joyeux, Baer and Timon-David (1934) compared the two species and concluded that they were identical. Timon-David (1953) collected specimens from a Magpie in which both species were represented. Dollfus (1954) suggested that var. nicolli be retained for those forms which have oral suckers which are equal to, or smaller than the ventral sucker, unlike the present type species for fuscatus. The writer has found specimens which show both varieties from a single host on several occasions, and in view of the need for a definitive study of the genus, has concluded that to differentiate those forms with smaller oral suckers as var. nicolli is pedantry.

The life-cycle of the species has been investigated by various workers, amongst whom Joyeux, Baer and Timon-David (1934)

and Timon-David (1953) are the most important.

Since Rudolphi's original descriptions from the Quail and the Missel Thrush, the trematode has been recorded from the Domestic Pigeon (Columba livia domesticus L.) by Stossich (1899), the Woodpigeon (Columba palumbus Pallas) by Braun (1902), from the Stone Curlew (Burhinus oedicnemus (L.)) by Andre (1917), from the House Sparrow (Passer domesticus (L.)) and the Rook (Corvus frugilegus L.) by Witenberg (1925), from the Corn Crake (Crex crex (L.)) by Semenov (1927), from the Carrion Crow (Corvus corone corone L.) by Markowskii (1933), and from the Magpie (Pica pica (L.)) by Timon-David (1953).

The first British records are from Baylis (1939) who found the species in the Woodpigeon, the Starling (Sturnus vulgaris L.) and the Jay (Garrulus glandarius (L.)). Mettrick (1958) has added the Blackbird (Turdus merula L.), the Songthrush (Turdus philomelos clarkii Hartert) and the Missel Thrush (Turdus viscivorus L.) to the British host list.

The writer's specimens are from the Rook (three from one host, Jan. 1960), the Carrion Crow (two from one host, April 1960), the Jackdaw (five from one host, August 1963), the Blackbird (ten from one host, Jan. 1962), the Woodpigeon (seven from one host, Feb. 1963), and the Starling (three from one host, Oct. 1960).

External Morphology

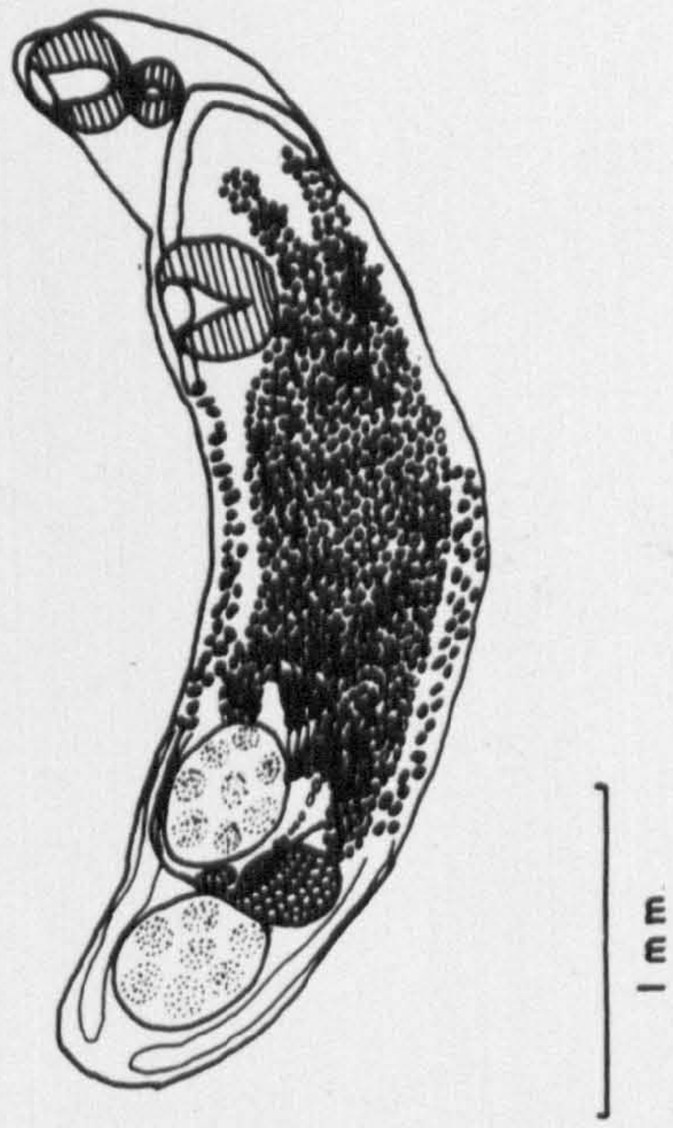
The body is elongate, rounded at both ends, 2.618 - 4.081 mm. long and 0.536 - 0.84 mm. broad in the yolk gland region (Figure 29). The cuticle is 0.016 mm. thick and covered with

Plate 20

Brachylaemus fuscatus (Rud., 1819)

Figure 29. Complete specimen.

29.



fine, pointed spines, 0.015 mm. long and 0.005 mm. at the base. They extend to the region of the anterior testis. The ovoid oral sucker is 0.17 - 0.33 mm. long and 0.235 - 0.332 mm. wide, with an opening of 0.14 mm. At a distance of 0.254 - 0.428 mm. along the body is the near-spherical ventral sucker, which in most specimens is slightly larger than the oral sucker; 0.24 - 0.364 mm. by 0.23 - 0.346 mm. Its opening is 0.14 - 0.145 mm.

Internal Morphology

a) Alimentary canal

The well-developed pharynx opens from the oral sucker and is 0.156 - 0.212 mm. long by 0.17 - 0.219 mm. wide. Its wall thickness is 0.042 - 0.058 mm. The intestinal bifurcation occurs immediately, and the caeca, which vary in diameter from 0.035 - 0.07 mm., extend laterally to within 0.04 - 0.07 mm. of the posterior tip where they are terminally dilated.

b) Musculature

Sections were not made.

c) Excretory system

The vesicle has a terminal pore and consists of an elongated sac which in the testes region gives rise to two longitudinal excretory ducts that pass laterally to the anterior end.

d) Reproductive system - Male

The testes are oval and in tandem. In the smaller specimens they are separated by the ovary, but in the larger specimens the ovary is frequently displaced laterally and the testes are nearly touching, (Figure 29). In contrast to Mettrick's

redescription the testes are longer than wide and the posterior testis is often the larger. The anterior testis is 0.319 - 0.492 mm. by 0.312 - 0.332 mm. while the posterior testis is 0.254 - 0.525 mm. by 0.17 - 0.425 mm. The vas efferens and vas deferens could not be traced and the cirrus sac, which is obscured by the uterine coils, is observed only with difficulty. In a typical specimen it is 0.23 mm. by 0.07 mm., the broadest portion being in the region of the much coiled seminal vesicle, 0.2 mm. long. The cirrus is 0.13 mm. long, without spines. No external seminal vesicle was found.

e) Reproductive system - Female

The ovary is elongate, 0.17 - 0.346 mm. by 0.113 - 0.254 mm. and at its posterior end is joined to Mehlis' gland by a short oviduct. The Mehlis' gland is 0.113 mm. by 0.07 mm. and is obscured from the ventral view by the yolk reservoir, 0.06 - 0.1 mm. by 0.04 mm. From the anterior end of Mehlis' gland the uterus arises and passes forwards between the ovary and the anterior testis. It undergoes much transverse coiling and completely fills the anterior two-thirds of the body. The metraterm opens alongside the cirrus sac into the genital atrium, which is anterior and slightly lateral to the anterior testis.

The vitellaria extend for some 0.82 mm. between the anterior testis and the ventral sucker. The eggs are 0.025 - 0.026 mm. by 0.014 - 0.017 mm.

Discussion

This text agrees well with the previous descriptions of the species (Table 18).

TABLE: 18 *Brachylaemus fuscatus* (Rud., 1819). Dujardin, 1843

Characters	Nettrick, 1958	Author
Length	3.3 - 4.4	2.618 - 4.081
Breadth	0.6 - 0.7	0.536 - 0.84
Body spines	-	0.015 - 0.005
Oral Sucker	0.23 - 0.27	0.17 - 0.333 X 0.235 - 0.332
" " opening	-	0.14
Pharynx	0.14 - 0.17 X 0.15 - 0.18	0.156 - 0.212 X 0.17 - 0.219
" wall thickness	-	0.042 - 0.058
Caecum width	-	0.035 - 0.07
Ventral Sucker	0.24 - 0.27 X 0.027 - 0.3	0.24 - 0.364 X 0.233 - 0.364
" " opening	-	0.14 - 0.145
Distance O. - V.	3rd of body	0.254 - 0.428
Anterior testis	0.24 - 0.35 X 0.27 - 0.39	0.319 - 0.492 X 0.312 - 0.332
Posterior testis	0.23 - 0.29 X 0.28 - 0.38	0.254 - 0.525 X 0.17 - 0.425
Cirrus sac	0.38 x 0.15	0.23 x 0.07
Cirrus	-	0.13
Seminal Vesicle	-	0.2
Ovary	0.17 - 0.21 X 0.2 - 0.24	0.17 - 0.346 X 0.113 - 0.254
Mehlis' gland	-	0.113 - 0.07
Yolk reservoir	-	0.06 - 0.1
Yolk follicle	-	0.07 x 0.04
Eggs	0.024 - 0.028 X 0.016 - 0.018	0.025 - 0.026 X 0.014 - 0.017

The Jackdaw (Corvus monedula L.) is a new host record, and the Rook (Corvus frugilegus L.) and the Carrion Crow (Corvus corone corone L.) are new host records for Britain.

This is the first record of the trematode from Wales.

Family: LEUCOCHLORIDIIDAE Dollfus, 1934

Syn. Urogonimidae Looss, 1899

S.F.: Leucochloridiinae Poche, 1907

Genus: Leucochloridium Carus, 1835

Syn. Urogonimus Monticelli, 1888

Neoleucochloridium Kagan, 1950

The genus Leucochloridium was erected by Carus (1835) for a larval trematode found in Succinea amphibia Drap. Zeller (1874) followed the development of the larva and found the adult to be Fasciola macrostoma Rudolphi, 1803, but it was Heckert (1889) who gave the first full account of the life-cycle and the genus. The genus Urogonimus was created by Monticelli in 1888 for Urogonimus cercatus (now a synonym of L. holostomum (Rud., 1819) and the family Urogonimidae by Looss (1899). The genus Urogonimus was utilised by Braun (1902) to include the known Leucochloridium spp., but Lühe (1909) reverted to Leucochloridium as the generic name and gives Urogonimus as a synonym, Poche (1907) having created the subfamily Leucochloridiinae.

The family Harmostomidae Odhner, 1912, included distomes from both mammals and birds, and Sprehn (1932) included the genus Leucochloridium in the subfamily Harmostominae Looss, 1900 (other workers - Harmostominae Braun, 1899), again giving Urogonimus as a synonym. Dawes (1946) included the subfamily Leucochloridiinae Poche, 1907 in the family Brachylaemidae Joyeux and Foley, 1930, giving Harmostomidae Odhner, 1912, and Leucochloridiidae Dollfus, 1934, as synonyms for the subfamily. Kagan (1950) also referred the genus to the Brachylaemidae. Yamaguti (1958) has utilised Dollfus' family Leucochloridiidae and supressed Harmostomidae Odhner, 1912, to Brachylaemidae Joyeux and Foley, 1930, so that while this latter family has representatives among both birds and mammals, Leucochloridiidae is confined to bird hosts.

The classification and synonymy of the genus has been in constant flux, the recent work of Bykhovskaya - Pavlovskaya (1951) and Kagan (1950, 1952) being contradictory and confusing. Kagan has accepted most of the created species, devised a new genus Neoleucochloridium and revived the generic name Urogonimus. His work is based on that of Szidat (1936), who recognised three basic morphological types:

a). genital glands in a straight line (Leucochloridium macrostomum Rudolphi, 1803),

b). genital glands in a triangle (Distomum macrostomum Zeller, 1874),

c). genital glands in a triangle with the uterus confined within the caeca anteriorly (Distomum holostomum Rud., 1819).

For each of these types Kagan has utilised a genus as follows:

a). Urogonimus, with Urogonimus macrostomus as type,

b). Leucochloridium with L. paradoxum Carus, 1835 as type,

c). Neoleucochloridium with N. problematicum (McGath, 1920) = (L. sorae McIntosh, 1927) as type. The genus Urogonimus has 14 species, Leucochloridium has 10 species and Neoleucochloridium has 6 species. Yamaguti (1958) has synonymised both Urogonimus and Neoleucochloridium with Leucochloridium.

Bykhovskaya - Pavlovskaya (1951) has retained the genus Leucochloridium as such and would appear to have given attention to Szidat's morphological types also. She concluded that the relevant characters are: the posterior limits of the yolk glands, the position of uterine coils with respect to the caeca and the relative positions of the gonads. She maintains that 18 species are synonyms and retains only 10 species. Of these ten species, Bykhovskaya expresses doubt as to the validity of five of them. She differentiates L. icteri McIntosh, 1927, from L. parcum Travassos, 1922, but suggests that some of the others may be synonyms and cites L. japonicum Ishii, 1932, and L. dasylophi Tubangui, 1928, as a possible example. Regret is expressed that material was not available to study these five in detail.

In an effort to simplify this confusion, the writer has tabulated the genera, valid species and synonyms so that the parallels between the respective classifications are made obvious (Table 19). Both authors appear to accept the same basic morphological criteria but whereas Kagan accepts nearly every species as valid, and places each of Szidat's morphological types

TABLE: 19 Comparison of the existing classifications for *Leucochloridium* spp.

Kagan 1950, 1952	Bykhovskaya-Pavlovskaya, 1951
Urogonimus species	
U. macrostomus (Rud., 1803)	1) *Leucochloridium macrostomus* (Rud.)
U. seiuri McIntosh, 1932	syn. *seiuri* McIntosh, 1932
U. dryobatae McIntosh, 1932	*dryobatae* McIntosh, 1932
U. witenbergi Skrjabin, 1848	*witenbergi* Skrjabin, 1948
U. certhiae McIntosh, 1927	*certhiae* McIntosh, 1927
U. cardis Yamaguti, 1939	*cardis* Yamaguti, 1939
U. mniotiltae McIntosh, 1927	*mniotiltae* McIntosh, 1927
U. witenbergiella Kagan, 1950	*L.* spp. Witenberg, 1925
U. vireonis McIntosh, 1927	*vireonis* McIntosh, 1927 *paradoxum* Carus, 1833
U. icteri McIntosh, 1927	2) *Leucochloridium icteri* McIntosh 1927
U. parcum Travassos, 1923	3) *Leucochloridium parcum* Travassos 1923
U. turdi Yamaguti, 1939	4) *Leucochloridium turdi* Yamaguti 1939
U. dasylophis Tubangui, 1928	5) *Leucochloridium dasylophi* Tubangui, 1928
Leucochloridium species	
L. paradoxum Carus, 1833	
L. cyanocittae McIntosh, 1932 syn. *actitis* McIntosh, 1932	6) *Leucochloridium actitis* McIntosh syn. *cyanocittae* McIntosh, 1932
L. sime Yamaguti, 1935	*sime* Yamaguti, 1935
L. variae McIntosh, 1932	*variae* McIntosh, 1932
L. melospizae McIntosh, 1932	*melospizae* McIntosh, 1932
L. heckerti Kagan, 1950 (ex. Wit., 1925	*insigne* Witenberg, 1925
L. pricei McIntosh, 1932	*pricei* McIntosh, 1932
L. australiense Johnston & Cleland, 1938	7) *Leucochloridium australiense* Johnston & Cleland, 1938
L. fucostriatum Robinson, 1948	
L. passeri Wu, 1938	
L. musculare Wu, 1938	
	8) *Leucochloridium phragmitophila* Bykhovskaya-Pavlovskaya and Dubinina, 1951
Neoleucochloridium species	
N. holostomum (Rud., 1819)	9) *Leucochloridium holostomum* (Rud.)
N. problematicum McGath, 1920 (syn. *sorae* McIntosh, 1927)	syn. *sorae* McIntosh, 1927
N. flavum Travassos, 1922	*flavum* Travassos, 1922
N. hypotaenidiarum Tubangui, 1932	*hypotaenidiarum*, Tubangui, 1932
	turanicum Solowiow, 1912
	insignis (Looss, 1892)
N. japonicum Ishii, 1932	10) *Leucochloridium japonicum* Ishii, 1932

as representative of a genus, Bykhovskaya goes to the other extreme and retains only one species for each type. Perusal of the literature without the relevant specimens only increases the problem and Yamaguti (1958) has avoided the issue by not accepting Bykhovskaya's synonyms and synonymising Kagan's new genus Neoleucochloridium.

The writer would query one aspect common to both workers, which is the extension of the uterine coils beyond the intestinal bifurcation to partially surround the oral sucker. There is consistency in that Kagan's Urogonimus and Leucochloridium spp. and Bykhovskaya's L. macrostomum and L. actitis all have uteri which extend beyond the bifurcation, while Neoleucochloridium and L. holostomum, japonicum, turdi and dasylophi (which are retained by Bykhovskaya) have uteri contained within the bifurcation, but the writer suggests that this character can be induced by flattening and is therefore not completely reliable. Another character which Kagan stresses in his diagnosis of Urogonimus is the relationship of the uterus to the ventral sucker, in which he states that it extends laterally before looping back around the ventral sucker and extending anteriorly on the alternate side. This is in contrast to the encirclement of the sucker by the uterus in Leucochloridium and Neoleucochloridium. In addition, the former character, that is the looping of the uterus around the ventral sucker, cannot be induced by flattening. The writer submits therefore that it should be included in any classification such as Bykhovskaya's

which accepts the position of the uterine coils with respect to the caeca as a diagnostic feature. Kagan somewhat undermines his genus Urogonimus by including species which have a triangular arrangement of the gonads as well as those which have the gonads in a straight line, and five in which the uterus surrounds the ventral sucker. This is in opposition to his criteria for the genus. It is noticeable that Bykhovskaya has not synonymised these species with L. macrostomum (Table 19). However, the writer disagrees with Bykhovskaya's synonymy of L. vireonis McIntosh, 1927, with L. macrostomum because of the triangular arrangement of the gonads, and suggests that it should be synonymised with L. parcum.

In his genus Leucochloridium, Kagan has synonymised McIntosh's species variae and pricei (1932). The original drawings show that in variae (p. 35) the uterus does not surround the ventral sucker, while in pricei (p. 51) it does so. This synonymy is therefore suspect. For the rest, Bykhovskaya's classification and synonymies are preferable to the acceptance of all and every species and the creation of new genera for such closely related species as demonstrated by Kagan.

The writer proposes the following scheme, which is essentially that of Bykhovskaya's modified to allow for the relationship of the uterus to the ventral sucker as well as the three previous criteria. It also includes three species described since her work: L. beauforti Hunter and Vernberg, 1952, L. ceylonicum Fernando, 1952, and L. perisorae Neiland, 1953. L. musculare

and L. passeri of Wu, 1938, which were omitted by Bykhovskaya, are synonymised with L. melospizae McIntosh, 1932.

1). (a). Coils of the uterus extend anteriorly beyond the intestinal bifurcation - 2.

(b). Coils of the uterus retained within the bifurcation - 7.

2). (a). The posterior part of the uterus does not reach the end of the body - 3.

(b). The posterior coils of the uterus extend to the posterior end of the body - 6.

3). (a). The vitelline glands extend behind the intestinal branches and also surround them. The gonads are in a triangle - 3.

(b). The vitelline glands do not reach the end of the intestine. The gonads are in a straight line - 4.

4). (a). The uterus encircles the ventral sucker - L. macrostomum (Rud., 1803), syn. witenbergi Skrjabin, 1948.

(b). The uterus loops back around the ventral sucker - L. certhiae McIntosh, 1927, syn. seiuri McIntosh, 1932, dryobatae McIntosh, 1932, cardis Yamaguti, 1939, and mniotiltae McIntosh, 1927.

5). (a). The uterus loops around the ventral sucker - L. actitis McIntosh, 1932, syn. cyanocittae McIntosh, 1932, and variae McIntosh, 1932.

(b). The uterus encircles the ventral sucker - L. melospizae McIntosh, 1932, syn. sime Yamaguti, 1935, heckerti Kagan, 1950, (for L. insigne Wit., 1925), pricei McIntosh, 1932,

passeri Wu, 1938 and musculare Wu, 1938.

6). (a). The uterus encircles the ventral sucker. The gonads in a triangle - L. parcum Travassos, 1922, syn. australiense Johnston and Clelland, 1939, and vireonis McIntosh, 1927.

(b). The uterus loops around the ventral sucker, the genital organs are in a triangle - L. icteri McIntosh, 1927, syn. L. beauforti Hunter and Vernberg, 1952.

7). (a). The uterus does not reach the posterior end of the body - 8.

(b). The uterine coils reach the posterior end of the body - 9.

8). (a). The vitelline glands extend beyond the intestinal branches. The gonads are in a triangle - L. phragmitophila Bykhovskaya and Dubinina, 1951.

(b). The vitelline glands do not extend beyond the intestinal branches posteriorly. Gonads in a triangle - L. holostomum (Rud., 1819), syn. sorae McIntosh, 1927, flavum Travassos, 1922, hypotaenidiarum Tubangui, 1932, turanicum Solowiow, 1912, and insignis (Looss, 1892).

9). The vitelline glands are rather more constricted than in the above species, the ventral sucker is post-equatorial and the cuticle may be spinose - L. japonicum Ishii, 1932, syn. turdi Yamaguti, 1939, ceylonicum Fernando, 1952, perisorae Neiland, 1953 and dasylophi Tubangui, 1928.

The writer does not imagine that this is a valid scheme that will stand the inevitable and essential test of the life-cycles

when these have been determined and which will indicate where the true relationships lie. The relationships of the uteri might well be secondary characters, but while helminthologists remain dependent on morphology alone, it is necessary to find a mean between the whole-sale rejection of characters as exemplified by Bykhovskaya - Pavlovskaya and the acceptance of every proportion and measurement as exemplified by Kagan. This has been the writer's aim in the above discussion and classification. It should be noted that Bykhovskaya in her paper refers to Figure 8 for the diagram of phragmitophila. The comparable figure is labelled L. minor. Again, McIntosh (1927) states that the ovary is on the left in L. icteri, but the diagram shows it as being on the right.

Bykhovskaya - Pavlovskaya's paper has been translated with the assistance of Dr. S. Markowskii of this Department.

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17). Leucochloridium certhiae McIntosh, 1927

Syns. L. seiuri McIntosh, 1932
L. dryobatae McIntosh, 1932
L. cardis Yamaguti, 1939
L. mniotiltae McIntosh, 1927

Leucochloridium certhiae was described by McIntosh (1927) from the cloaca of the Brown Creeper (Certhia familiaris americana ?) in North America. In 1932, he added the Song Sparrow (Melospiza melodia beata (Wilson)) to the host list and queried whether Witenberg's L. spp. (1925) from the Spotted Flycatcher (Muscicapa striata Pallas) in Russia should be considered as the same species. Subsequent records are the Black and White Warbler (Mniotilta varia ?), the Hairy Woodpecker (Dryobates villosus villosus (L.)), the Ovenbird (Seiurus aurocapillus aurocapillus (L.)) in North America and the Grey Japanese Ouzel (Turdus cardis cardis Temminck) in Japan.

A single specimen was found in the small intestine of the Tree-Creeper (Certhia familiaris L.) in March 1961, and later a single specimen was obtained from the rectum of the Spotted Flycatcher (Muscicapa striata Pallas) in June, 1962. Both birds were taken in Trevayne Woods, Saundersfoot. The specimens were stained and mounted and later that from the Flycatcher was de-mounted and sectioned.

External Morphology

The trematode is oval rounded at both ends and at its greatest diameter across the ventral sucker. The measurements for the two species are (a) from the Tree-Creeper: length,

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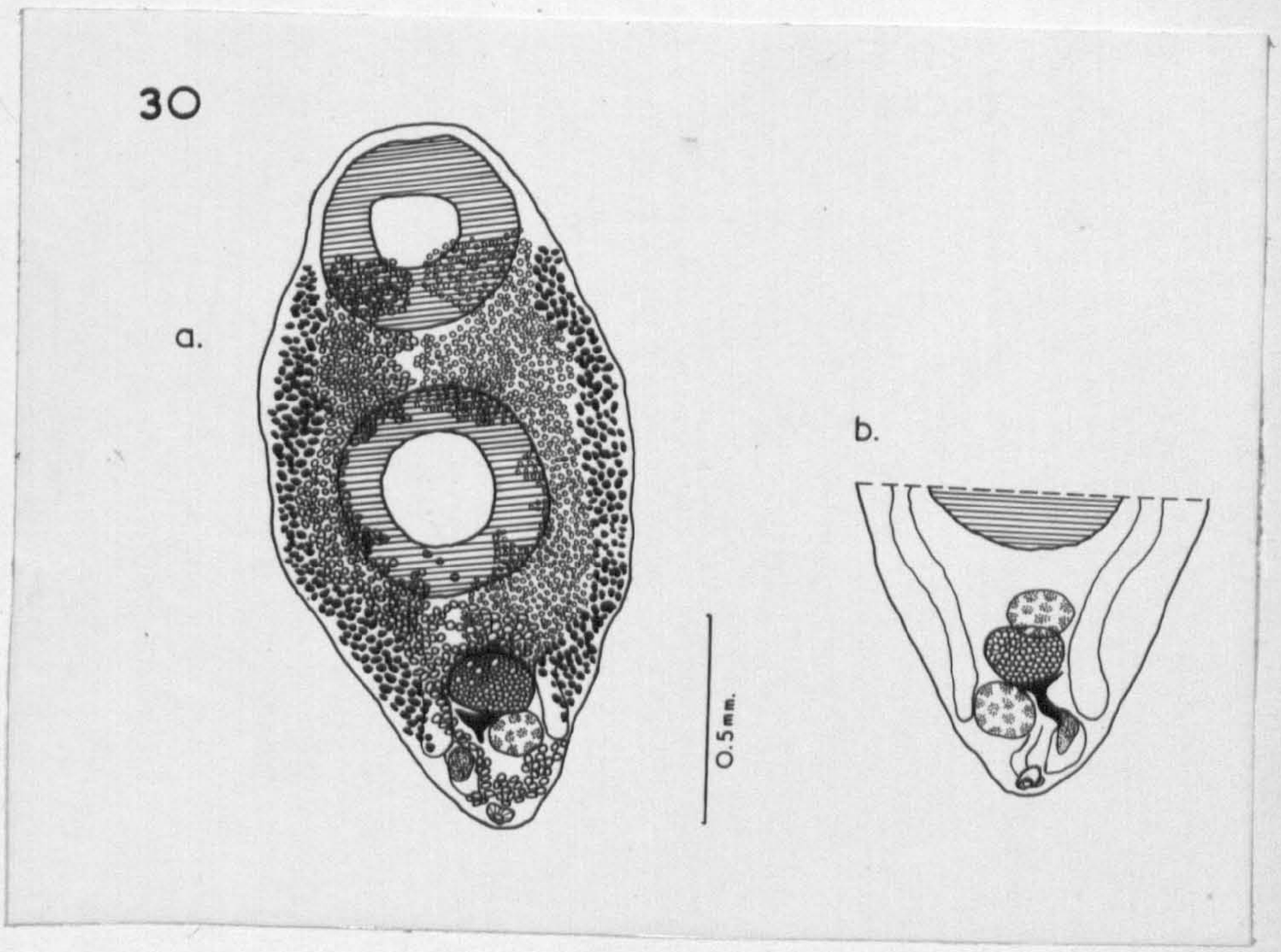
Plate 21.

Leucochloridium certhiae McIntosh, 1927.

Figure 30a. Complete specimen.

b. Posterior end.


30
a.
b.
0.5mm.

1.736 mm., breadth, 0.854 mm., (b) from the Spotted Flycatcher: length, 1.6 mm., breadth, 0.79 mm. There are no spines on the body. The oral sucker is large and muscular, 0.45 - 0.48 mm. long and 0.46 - 0.494 mm. broad, with an opening of 0.19 - 0.205 mm. The ventral sucker is in the middle of the body, 0.165 mm. from the oral sucker. It is a little larger, equally muscular and more rounded, 0.505 and 0.49 mm. from the respective hosts. It is 0.595 mm. from the posterior end, (Figure 30 a).

Internal Morphology

a) Alimentary canal

The oral sucker leads directly into the pharynx, which is 0.212 mm. long and 0.198 mm. wide, with a wall-thickness of 0.07mm. There is no oesophagus, the caeca bifurcating immediately. They extend laterally to the middle of the posterior testis and are dilated at their termination.

b) Musculature

The cuticle is 0.003 - 0.005 mm. thick and overlies the outer circular muscle fibres, the longitudinal muscle fibres and the inner oblique muscle fibres. The muscles are uniformly distributed throughout the body wall.

c) Excretory system

The small vesicle, 0.03 mm. in diameter, is dorsal to the cirrus sac and opens in the midline anteriorly to the genital atrium on the dorsal surface.

d) Reproductive system - Male

The testes are intercaecal and found in a straight line

which is at a slight tangent from the midline of the body. They are rounded and separated by the ovary which overlaps the anterior testis in the Tree-Creeper specimen and the posterior testis in the Spotted Flycatcher specimen. The posterior testis is slightly larger with a diameter of 0.15 mm. as opposed to 0.135 mm. for the anterior testis. The distance between them is 0.135 mm. Each gives rise to a vas efferens on the postero-dorsal surface which joins its companion to form the vas deferens. The appearance is of an inverted Y, the thickened stem being the vas deferens which incorporates the function of a seminal vesicle. It leads into the vesicular and thin-walled cirrus sac. The pars prostatica cells are seen as a globular mass within the cirrus sac, 0.1 mm. by 0.048 mm. The cirrus sac itself is 0.135 mm. long and 0.083 mm. wide. The cirrus was not everted and in its inverted form has a curious egg-cup shape, 0.065 mm. long and 0.045 mm. wide.

The genital atrium is on the dorsal surface, 0.035 mm. from the posterior end of the body. Figure 30 b, is drawn from the dorsal surface.

e) Reproductive system - Female

The ovary is situated between the testes and is an oval body, 0.156 mm. long and 0.22 mm. across. The ovicapt is on the postero-ventral surface and gives rise to an ovicapt 0.02 mm. wide. This bends dorsally to receive Laurer's canal and then expands to form Mehlis' gland. This small body is found only in cross-section because of the mass of ova in this area. The central chamber is 0.028 mm. in diameter. The uterus extends dorsally

on the left side and crosses over the caeca to a level with the posterior third of the oral sucker. It then loops back, forming numerous convolutions between the oral and ventral sucker, before passing backwards round the ventral sucker to follow a similar course on the right side of the body. The immature eggs on the left side are yellowish in colour, while those on the right are dark brown. This makes the course of the uterus easy to follow even under a dissecting microscope. There are more uterine coils in the posterior region before it straightens out to open to the right of the cirrus into the genital atrium.

The yolk follicles extend from the beginning of the posterior third of the oral sucker to the ends of the caeca which they cover in part. The follicle size varies from 0.017 to 0.03 mm.

The mature eggs are 0.027 - 0.029 mm. long and 0.018 mm. wide.

Discussion

In the introduction to the genus, the writer's reasons for not accepting Bykhovskaya - Pavlovskaya's synonymy with *L. macrostomum* are given. It is interesting to note that Witenberg's drawing for his L. spp. (1925) from the Spotted Flycatcher shows a uterus which encircles the ventral sucker, unlike the writer's specimen from the same host.

The trematode has not previously been recorded from Europe and both are new host records.

18). Leucochloridium melospizae McIntosh, 1932

Syns. Distomum macrostomum Heckert, 1889
Leucochloridium insigne Witenberg, 1925 (nec Looss 1899)
Leucochloridium pricei McIntosh, 1932
Leucochloridium sime Yamaguti, 1935
Leucochloridium heckerti Kagan, 1950

Looss (1899) described Leucochloridium insigne in the Coot (Fulica atra L.) from Egypt. This species was redescribed by Witenberg (1925) who included four drawings in his text. The first of these drawings (Figure 10) is obviously different from the remaining three and various authors have since referred to it as L. insigne Witenberg (1925), despite the fact that the specific name is occupied by Looss' species. Kagan (1950) considered it to be identical with Heckert's erroneous description for Distomum macrostomum (1889) and erected the species L.heckerti to co-ordinate Witenberg's drawing and Heckert's description. Bykhovskaya - Pavlovskaya (1951) considers L. insigne Witenberg (1925) to be a synonym of L. actitis McIntosh, 1932, a view with which the writer is not in agreement, since the uterus of Witenberg's Figure 10 completely surrounds the ventral sucker.

In 1935, Hsü (1936) obtained specimens from the Ruff (Pavoncella pugnax L.) in Kurischen Nehrung by the Baltic Sea. He gave a table of measurements and three diagrams, the second of which is nearly identical with forms found by the writer. Hsü considers this second form to be an anomaly and with regard to the very scattered yolk follicles this must be so. Hsü points

out that it is very similar to actitis, which Bykhovskaya places as the type of the group in her scheme. Hsü's "typical" form resembles melospizae McIntosh, 1932, so that there is no real anomaly exhibited between the different forms illustrated by him.

The species L. melospizae McIntosh, 1932, has been recorded from the Song Sparrow (Melospiza melodia beata (Wilson)) and the Alaskan Spruce Grouse (Carachites canadensis osgoodi Bishop) in North America and the Black-tailed Hawfinch (Coccothraustes japonicus Temminck and Schlegel) in Japan by Yamaguti (1935).

There are no British records for this species. The writer's specimens were found in the rectum and small intestine of a single Starling (Sturnus vulgaris L.) shot in January, 1961. Over 170 Starlings were examined but no other Leucochloridium spp. were found. Three of the thirteen specimens were sectioned, two transversely and the third sagittally.

External Morphology

The trematodes are rather rectangular in shape with rounded extremities, and measure 1.12 - 1.274 mm. long and 0.05 - 0.63 mm. wide, (Figure 31). The cuticle is devoid of spines. The oral sucker completely fills the anterior end of the body and is very muscular, slightly wider than long, measuring 0.32 - 0.4 mm. long by 0.4 - 0.428 mm. wide. The ventral sucker is in the middle of the body, at a distance of 0.11 mm. from the oral sucker. It is slightly larger than the oral sucker but in two of the nine mounted specimens, it is smaller. It measures 0.4 - 0.466 mm. long and 0.333 - 0.42 mm. wide, and is 0.49 mm. from the anterior

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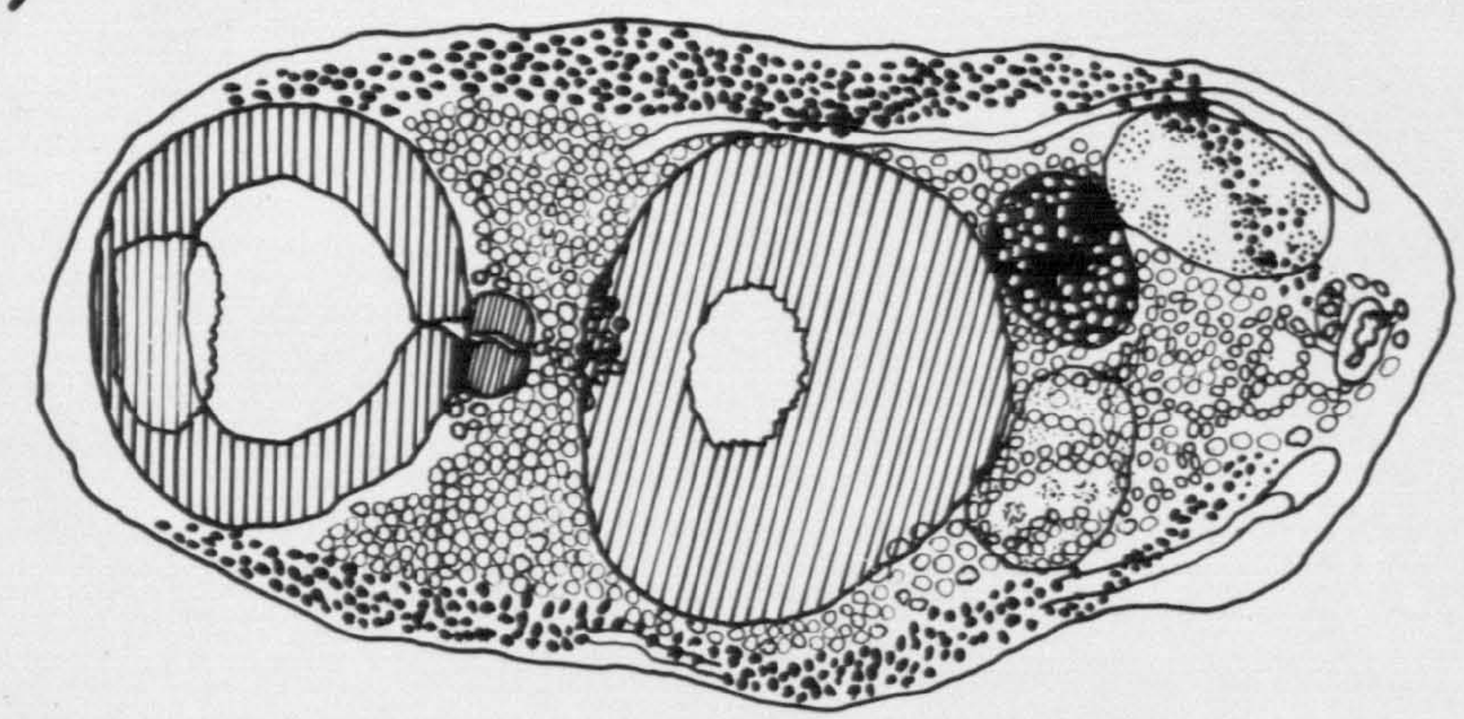
Plate 22

Leucochloridium melospizae McIntosh, 1932

Figure 31. Complete specimen.

31.



0.5 mm.

extremity and 0.346 mm. from the posterior extremity. The two suckers between them occupy nearly half the body length. The wall thickness of the suckers is, on average, 0.08 mm.

Internal Morphology

a) Alimentary canal

The oral sucker opens directly into the pharynx which is 0.1 mm. long and 0.17 mm. in diameter. The intestinal bifurcation occurs immediately, each caecum passing laterally to within 0.06mm. of the body tip. The right caecum is dilated terminally but the left, which is adjacent to the left testis, is of uniform diameter.

b) Musculature

The cuticle is 0.003 - 0.005 mm. thick and beneath it is found the usual muscle layers, circular, longitudinal and oblique, each one fibre thick.

c) Excretory system

The round excretory vesicle is found overlying the cirrus sac at the posterior end of the body. Its diameter is about 0.03 mm. The pore opens dorsally in the midline anterior to the genital atrium. The lateral vessels have a diameter of 0.008 mm.

d) Reproductive system - Male

The testes are intercaecal and occupy most of the posterior end of the body. The right testis is anterior and adjacent to the ventral sucker. It is wider than long (0.089 mm. by 0.115mm.) and in cross-section is oval to triangular in outline, the surface next to the ventral sucker being flattened. The posterior testis, on the left side, is longer than wide (0.22 mm. by 0.165mm.

and is oval in cross-section. The anterior end, which touches the ovary, is frequently flattened. The vas efferens arises postero-dorsally and joins that from the anterior testis to form a short vas deferens. The cirrus sac is elongate and contains the pars prostatica complex, the vas deferens fulfilling the function of a seminal vesicle as it joins the cirrus sac. Its diameter at this point is 0.038 mm. The cirrus was not seen extruded but the cross-sections showed that it is not spinose. Its diameter within the genital atrium is 0.034 mm.

e) Reproductive system - Female

The ovary is found at a level with the anterior testis, on the left side, between the ventral sucker and the posterior testis. Its diameter is 0.09 mm. on average. The oöcytes are 0.008 mm. in diameter, the ovicapt occuring on the dorsal side and the oviduct turning posteriorly to receive first Laurer's canal and then the yolk ducts before entering Mehlis' gland. Laurer's canal is 0.009 mm. wide and the central duct is 0.003 mm. in diameter. It opens on the dorsal surface immediately above the ovary to the left of the midline. The yolk ducts (diameter 0.012 mm.) pass inwards to join the yolk reservoir which is in the midline on a level with the posterior testis. The left-hand yolk duct crosses ventrally over the posterior testis. The reservoir itself is 0.05 mm. long and 0.022 mm. wide. From Mehlis' gland, the uterus turns abruptly forwards and the eggs within it can be seen in the initial stages of division. The uterus shows much convolution ventral to the anterior testis and the ovary and passes a fairly direct course on the left side to the anterior end of the body,

where it crosses over the intestine to a level with the posterior third of the oral sucker. It then loops back to the dorsal side of the ventral sucker, passes to the right side and again crosses over the intestine. There are a great many convolutions in this area and the pharynx is most often obscured. It passes posteriorly to the right of the ventral sucker and in the post-acetabular region forms many more convolutions before entering the metratern. The metratern is thick-walled (0.035 mm.) with a cavity of 0.027 mm. It enters the genital atrium after running alongside the cirrus for some 0.15 mm. The atrium is very muscular and opens on the dorsal side about 0.03 mm. from the posterior end.

The yolk follicles are 0.025 mm. in diameter and extend from the middle of the oral sucker to the posterior end of the body, where they tend to cross over the testis on each side. For most of their course they surround the caeca.

The eggs are thick-shelled with a length of 0.023 - 0.03 mm. and a diameter of 0.018 mm. The operculum is terminal, at the more pointed end.

Discussion

According to the taxonomic features in the scheme above, the species described agrees very well with L. melospizae. The writer has not tabulated the measurements for the various specimens found or those of the various species considered to be synonymous with melospizae because the relative sucker measurements, genital organ measurements, etc., show a variation which is not considered to be significant in this classification.

Although recorded from Passeriformes and Charadriiformes in North America, this is the first record of the species in a Passeriform in Europe, since Hsü's specimens were collected from a Charadriiform. The Starling (Sturnus vulgaris L.) is a new host and this is the first record of the trematode for Britain.

Addendum

Since the preparation of this text the writer has read "Experimental development of Leucochloridium spp. (Trematoda: Brachylaemidae)", by Teresa Pojmanska (1963), in Acta Parasit. Polon., v.11, 153-159.

The species described is not named, but as the author indicates, would be actitis according to Bykhovskaya - Pavlovskaya. She then criticizes that scheme for exactly the same reasons stated above, viz., the specific character in both metacercaria and adult of the uterine course. In the modified classification devised for the present work, the experimental species can be regarded as a synonym of melospizae, not actitis. Miss Pojmanska further criticizes Bykhovskaya's scheme in that different types of sporocyst would give rise to the same species of trematode. This last objection is not relevant to this new classification and provides unexpected support for the thesis expounded herein.

PART I Section B.

Phylum PLATYHELMINTHES

Class Cestoda.

The classification in this section is based primarily on Fuhrmann (1932), Baer (1954) and Yamaguti (1959). Any departure is accounted for under the appropriate species.

Order - PSEUDOPHYLLIDEA Carus, 1863.

FAMILY: DIPHYLLOBOTHRIIDAE Lühe, 1910.

S.F.: Ligulinae Lühe, 1910.

Genus: Ligula Bloch, 1782.

1). Ligula intestinalis (Linnaeus, 1758) Bloch, 1782.

The well-known species Ligula intestinalis was redescribed and its history reviewed by Cooper, 1918. The larvae are found in fish and the adults in fish-eating birds. The many recorded hosts throughout the world are too numerous for inclusion.

The first British record is from Baylis (1928) in the Great Crested Grebe (Podiceps cristatus (L.)) and in 1939 from the Razorbill (Alca torda L.), the Shag (Phalacrocorax aristotelis(L.)) and the Goosander (Mergus merganser L.). Pemberton (1963) found it in the Black-headed Gull (Larus ridibundus L.).

The writer's four specimens were recovered from the intestine of a Great Crested Grebe.

External Morphology

The cestodes are up to 20 cms. long and very thick and muscular. The maximum breadth is 6 mm. Only the anterior end shows any sign of segmentation and this is superficial, not reflected by internal division. This pseudosegmentation extends for some 1.3 cms. behind the weakly-developed triangular scolex, which has a pair of grooves on both surfaces that indicate the poorly defined bothria.

Both the dorsal and ventral surfaces are flattened and bear a median groove. This groove on the ventral surface contains the openings of the genital organs. The posterior end is rounded.

Internal Morphology

a). Musculature

The cuticle varies from 0.005 - 0.05 mm. in thickness and shows a variation in structure which is not easily interpreted by normal staining methods. The outermost, clear area seems to be ciliated; Cooper (1918) refers to a "delicate pseudociliated layer." Beneath the cuticular layer is the complex muscle system, which has an outer circular layer 5 - 10 fibres thick enclosing numerous bundles of longitudinal fibres. At the anterior end of the body these layers appear to intermingle greatly. Beneath the vitelline glands is a second layer of longitudinal muscle bundles and enclosing the medulla is a thick layer of transverse muscles. The thickness of these muscle layers varies to such an extent in the different cross-sections made, depending on the position along the body, state of relaxation, etc., that measurements are more or less invalid. The parenchyma contains numerous calcareous bodies which are ellipsoidal in shape, 0.014 - 0.021 mm. by 0.011 to 0.018 mm.

b). Excretory System

The excretory system is in close agreement with the description of Byrd (1955) who states that there are ten longitudinal ducts in each lateral half of the worm. The two largest are within the medulla, while the other eight on each side are cortical, external to the vitelline glands. One of these latter lies laterally and there are two ventral and five dorsal vessels. Cooper (1918) states that the cortical vessels form a plexus and the variability in different sections suggests that this interpretation is more correct. Both Von Linstow(1901)

and Cooper observed a second, indistinct series between the inner longitudinal and transverse muscles. This was not found.

c). Reproductive System

The genitalia commence 6 mm. behind the anterior end. Byrd states 4.92 mm. and Cooper 10 mm. The distance between individual sets varies on the state of contraction of the worm. In some sagittal sections they are only 0.03 mm. apart, while in a very relaxed piece of worm which was mounted whole they are up to 0.7 mm. apart. Cooper states 0.05 - 0.2 mm., von Linstow 0.13 - 0.15 mm. and Byrd 0.27 mm. Because of the voluminous nature of the sets of genitalia, the writer's measurements are those between the groups of genital pores on the ventral surface. The genital atrium is an irregular, transverse depression into which the respective pores open. The vaginal opening lies always between the lateral uterine and cirrus pores, and these latter alternate irregularly from side to side.

d). Reproductive system - Male

The testes lie in a continuous line on the dorsal side of the medulla and are contiguous throughout the entire medulla, with no groupings corresponding to respective sets of genitalia. There are some 20 - 35 in transverse section which are oval with greatest diameter occuring dorso-ventrally, not transversely as stated by Cooper. They are on average 0.14 mm. deep, 0.065 mm. wide and 0.1 mm. long. The dorsal row is broken by uterine coils. The vas deferens is loosely coiled above the cirrus sac. It is 0.04 mm. wide and opens into an oval, thin-walled seminal vesicle which varies from 0.07 - 0.1 mm. in length and 0.04 -

0.085 mm. in diameter. The cirrus sac, which alternates irregularly from side to side, is approximately 0.2 mm. dorso-ventrally and 0.15 mm. wide. The ductus ejaculatorius is roughly 0.065 mm. long and 0.025 mm. wide. The cirrus is difficult to observe within the cirrus sac, but in one specimen in which it was everted it was 0.07 mm. long and 0.036 mm. wide. There were no spines.

e). Reproductive system - Female

The ovary is longitudinally bilobed and always situated on the opposite side of the midline from the cirrus pouch. It is up to 0.11 mm. wide and 0.07 mm. deep in cross-section. The oviduct is 0.015 mm. in diameter and joins the vitelline duct just prior to the yolk reservoir, which is up to 0.035 mm. in diameter. The uterus is greatly convoluted and fills much of the medulla around the genital atrium, the average diameter being 0.05 mm. The eggs are in agreement with Cooper's measurements, namely 0.05 mm. by 0.032 mm.

The vagina follows a straight course through the cortex before turning laterally to join the oviduct. Just prior to this fusion it increases in diameter to form an elongated receptaculum seminis.

The vitelline follicles are found both dorsally and ventrally external to the muscle layers. They are contiguous except for the opening of the genitalia on the ventral surface.

Discussion

This description agrees in all principal points with the redescription of Byrd (1955).

The cestode has not previously been recorded from Wales.

Order - TETRABOTHRIDEA Baer, 1954.

Family: TETRABOTHRIIDAE Braun 1900.

In 1954, Baer revised the family Tetrabothriidae and raised it to the order Tetrabothridea. This classification has not been accepted by all helminthologists: Yamaguti (1959) for example, retains the family within the Order Cyclophyllidea.

Genus: Tetrabothrius Rudolphi, 1819.

syn. Tetrabothrium Diesing, 1856.

Eutetrabothrium Diesing, 1856.

Bothriocephalus Baird, 1862.

Amphryocotyle Diesing, 1863.

Prosthecocotyle Monticelli, 1892.

Bothridotaenia Lönnberg, 1896.

Tetrabothrium Fuhrmann, 1932.

Rudolphi (1819) included four species in his genus Tetrabothrius; cylindraceus, macrocephalus, auriculatum and tumidulum. Auriculatum is now placed in the genus Anthobothrium and tumidulum in the genus Echeneibothrium. Macrocephalus was long regarded as the type of the genus but Baer (1954) synonymised it with immerinus (Abildgaard, 1790) and this is now accepted as the type.

Fuhrmann(1899) supported Brosthecocotyle of Monticelli,1892 as the generic name but was strongly opposed by von Linstow(1900), who saw no valid reason why Tetrabothrius macrocephalus should be displaced by Prosthecocotyle forsteri(Kreft,(?) Monticelli,1892. Workers since this date have followed von Linstow and given Prosthecocotyle as a synonym of Tetrabothrius.

2). Tetrabothrius cylindraceus (Rud.,1819) Diesing, 1850.

syn. Bothriocephalus cylindraceus,(Rud.,1819)

Bothridiotaenia cylindraceus (Rud.,1819)Lönnberg,1896

Taenia sternae (Rud.,1819) Fuhrmann, 1908.

Rudolphi (1819) found this species in the Black-headed gull (Larus ridibundus L.), the Common Gull (Larus canus L.), and the Great Black-backed Gull (Larus marinus L.). and the Kittiwake (Rissa tridactylae (L.)). Later records are from Cobbold (1861) in the Glaucous Gull (Larus hyperboreus Gunn), Stossich (1895) in the Common Gull and von Linstow (1900) in the Kittiwake. The many subsequent hosts include the Laughing Gull (Larus atricilla L), the Sooty Gull (Larus hemprichi (Br.)), Mediterranean Black-headed Gull (Larus melanocephalus Nathaniel), Royal Tern (Sterna maxima Martert), the Common Guillemot (Uria aalgae (Pont.)), the Manx Shearwater (Puffinus puffinus Brünnich), and Sabine's Gull (Xema sabinei Sabine).

The Cobbold record above is the first British record. The cestode has since been found in the Herring Gull by Solomon(1934), the Herring Gull and Manx Shearwater by Baylis (1939), the Herring Gull and Common Gull by Williams (1962) and the Herring Gull (Pemberton 1963). The author records the worm from the Great Black-backed Gull(26 out of 33 birds infected), the Lesser Black-backed Gull (8 out of 9 hosts), the Herring Gull (4 out of 17), the Common Gull (1 out of 5) and the Puffin (Fratercula artica (L.)). The specimens from the Great Black-backed and Lesser Black-backed Gulls were found throughout the years, 1960,

1961, 1962, 1963, while the Herring Gull specimens were found only in the summer months. There were only two immature specimens in the Common Gull and a single scolex in the Puffin.

External Morphology

The cestodes are up to 200 mm. long when relaxed, and 0.08 mm. - 2 mm. broad. The scolex is 0.35 mm. long and the diameter varies from 0.22 mm. across the anterior end to 0.36 mm. across the posterior end (Figure 32). There are four bothridia, two dorsal and two ventral, and each bothridium is 0.255 mm. long and 0.15 mm. wide. The muscular wall of the bothridium is 0.016 mm. thick. At the anterior end, each is overlapped by a thick, muscular auricle, which overlaps the bothridium and is inconspicuous from certain angles. The neck is 1 - 1.5 mm. long and 0.1 - 0.15 mm. broad.

Internal Morphology

a). Musculature

Sectioning showed that the longitudinal muscles are in two distinct layers of which the outer layer, with approximately 20 fibres per bundle, is the larger. There are 3 - 7 fibres per bundle in the inner layer.

b). Excretory system

The excretory system consists of the usual longitudinal dorsal and ventral vessels, the ventral vessels always possessing a transverse duct at the end of the proglottid, while the dorsal vessels are also connected intermittently in this region. The ventral vessels are 0.02 mm. in diameter in the immature segments and 0.07 - 0.08 mm. in diameter in the gravid segments. The

dorsal vessels are a uniform 0.015 mm. in diameter throughout the strobila.

c). Reproductive System

The genital ducts pass between the vessels to connect with the large, muscular genital atrium, which is equatorial and dextral in each proglottid.

The proglottids are always broader than long, a typical mature segment measuring 0.375 mm. by 0.728 mm. and a gravid segment, 0.35 mm. by 1.108 mm. (Figure 34). The genitalia are patent in the 120th. to 150th. segment.

There are 22 testes per proglottid (rarely 20 - 25), which encircle the female genitalia and are 0.05 mm. in diameter (Figure 33). They overlap the ovary on the dorsal side. The vas deferens is a convoluted mass on the dorsal side of each segment, 0.015 mm. in diameter and occupying the space between the cirrus sac and the mid-line. The cirrus is small and vesicular, near-spherical, 0.45 - 0.06 mm. in length. It contains a convoluted ductus ejaculatorius which connects to a canalis masculinus, 0.055 mm. long, and which opens into the genital strium. This opening is on what is generally described as a papilla but appears in cross-section to be an additional muscular part of the male system and constitutes the canalis masculinus and the inverted cirrus. It is 0.04 mm. long and 0.025 mm. wide (Figure 35). The cirrus is not armed.

The genital strium itself is sub-globular and approximately 0.165 mm. in diameter. Ventral to the canalis masculinus is the vaginal opening which is not raised as a "papilla." The vagina

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Plate 23

Tetrabothrius cylindraceus (Rud., 1819)

Figure 32. Scolex. H.P. X 6.

Figure 33. Mature segment. H.P. X 2.

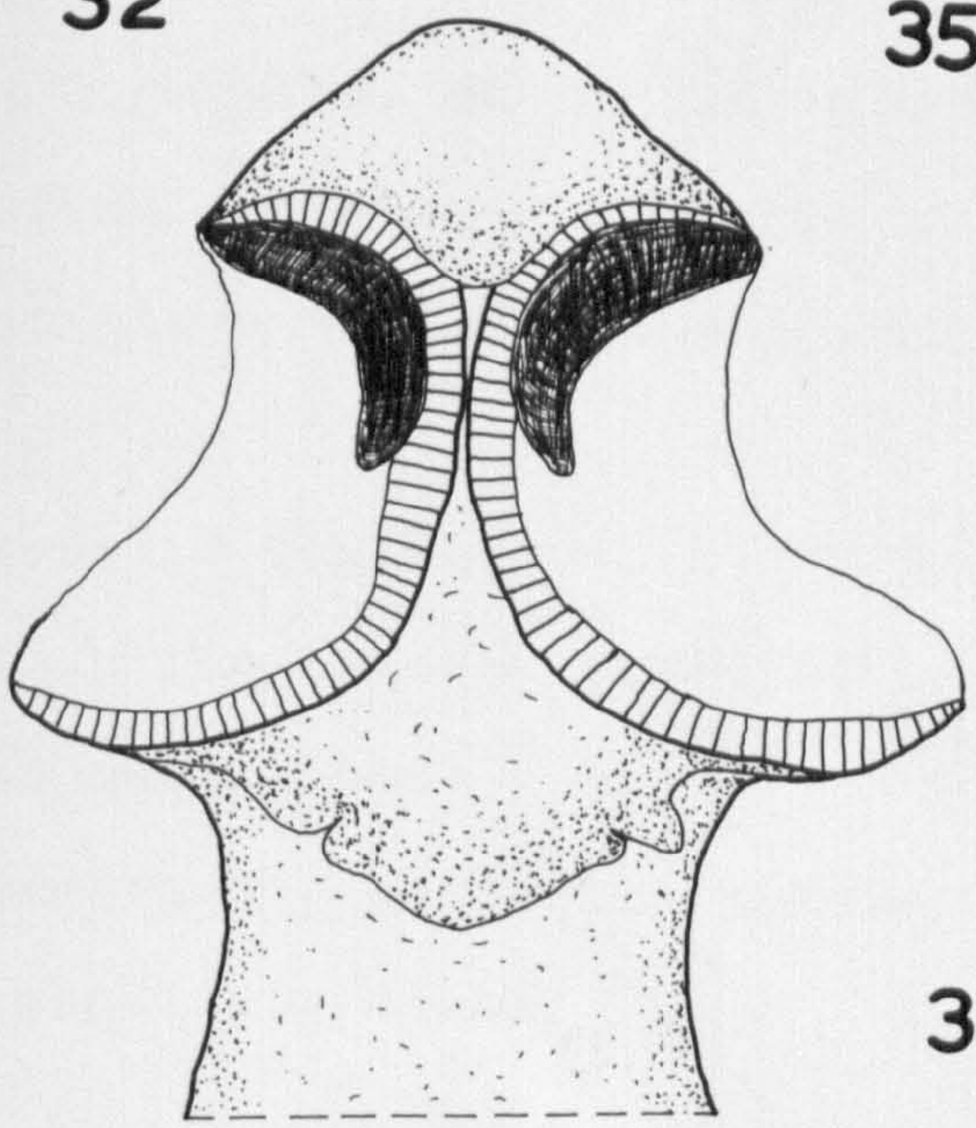
Figure 34. Gravid segment. L.P. X 10.

Figure 35. Cirrus sac 'in situ'. Oil.

Tetrabothrius erostris (Lönnberg, 1889)

Figure 36. Early mature segment. H.P. X 2.

32



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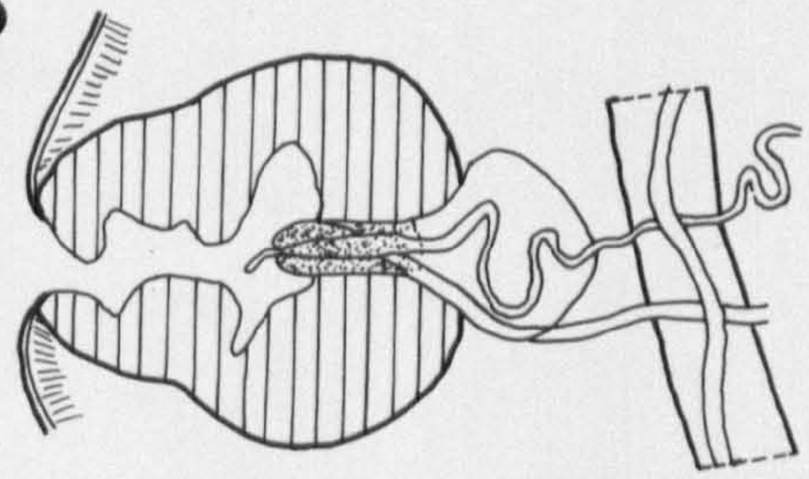

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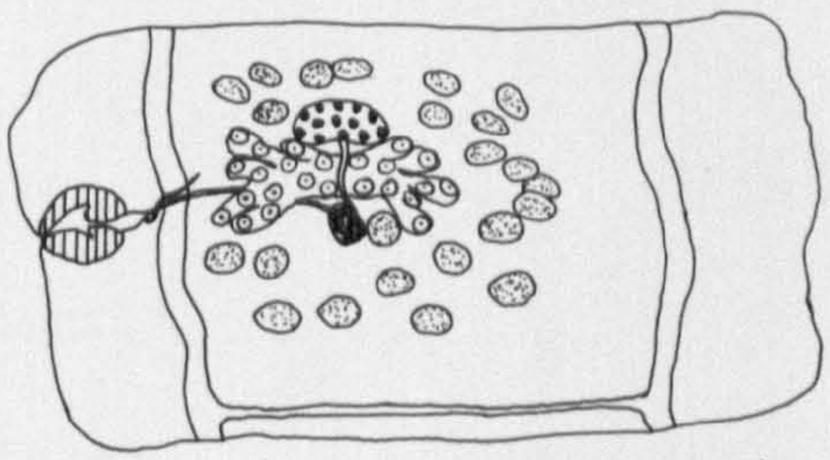

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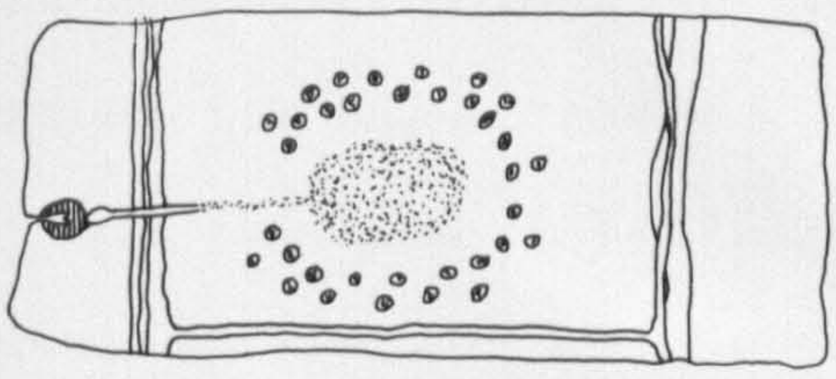

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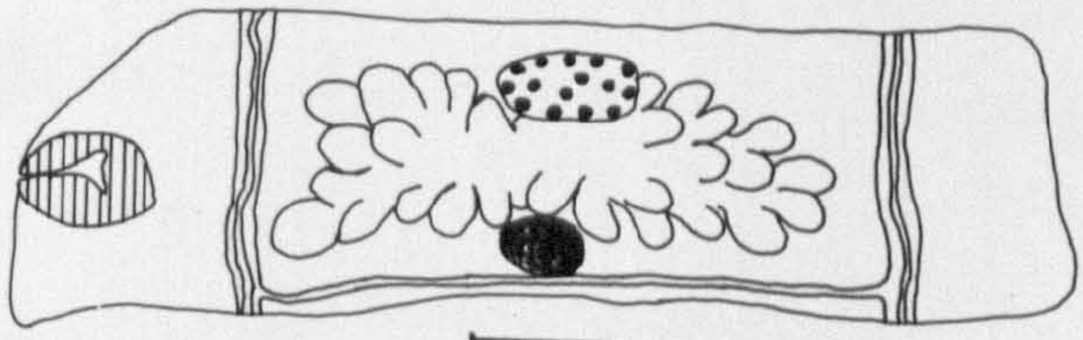

0·5 mm.

passes first ventrally and then postero-dorsally into the globular receptaculum seminis (0.03 mm. by 0.06 mm.) before receiving the short oviduct (0.01 mm.) and enlarging to form Mehlis' gland. It is 0.02 mm. in diameter. Mehlis' gland in the gravid segment is 0.110 mm. in diameter. It is ventral to the ovary and obscured by the testes in the mature segments. The ovary is bipartite, each half possessing 5 - 8 lobes, and measures 0.27 mm. across. Anterior and dorsal to the ovary is the vitelline gland which in the gravid segment is 0.13 mm. in diameter.

The uterus is continuous with Mehlis' gland and enlarges to fill completely the inter-vascular area. It is dorsal to the ovary and has many lobes. The ova are 0.045 mm. in diameter and have three membranes, while the onchosphere measures 0.026 mm. and has the usual six hooks.

Discussion

This text compares well with previous descriptions for the species, of which the most recent redescriptions are those of Linton (1927) and Yamaguti (1940).

The Great Black-backed and Lesser Black-backed gulls are new British host records. This is the first redescription of the species from British material.

The Puffin (Fratercula artica (L.)) is a new host record for this species.

3). Tetrabothrius erostris (Lönnberg, 1889) Linstow, 1900.

syn. Taenia erostris Lönnberg, 1889.

Bothridiotaenia erostris (Lönnberg,1889) L.,1896.

Prosthecocotyle erostris (L.,1889) Fuhrmann,1899.

Prosthecocotyle eudyptidis (L.,1893) Fuhrmann,1899

(for Bothridiotaenia erostris var. eudyptidis Lönnberg, 1893)

Tetrabothrius lari Yamaguti, 1935.

Lönnberg recorded Taenia erostris in the Great Black-backed Gull (Larus marinus L.), the Lesser Black-backed Gull (Larus fuscus L.) the Herring Gull (Larus argentatus Pont.), the Common Gull (Larus canus L.), the Kittiwake (Rissa tridactyla (L.)) and the Common Tern (Sterna hirundo L.), from Europe and North America in 1889.

In 1893, Lönnberg described two varities, minor in the Fulmar Petrel (Fulmarus glacialis (L.)) from Greenland and var. eudyptidis in the Royal Penguin (Eudyptidis chrysolophus (Brandt)) from Tierra del Fuego. In 1896 he placed the species in a new genus Bothridiotaenia but Fuhrmann, 1899, synonymised this genus with the genus Prosthecocotyle Monticelli, 1892, and raised both varities to species.

Since von Linstow's criticism (1900), the species has been incorporated in Tetrabothrius Rudolphi, 1819 and the testes number by means of which Lönnberg differentiated his variety eudyptidis (50 - 60) seems to have been ignored by subsequent workers. Lönnberg's second variety minor (8 - 12 testes) was recognised as a distinct species by Johnston (1937) and Baer (1954) has synonymised two other species with it.

British records are the Herring Gull - McIntosh and Nicoll (1927), Davies (1937), unpubl.), Pemberton (1963), the Common Gull - McIntosh and Nicoll (1927), the Iceland Gull (Larus glaucoides Mayer) - Baylis (1939), Lesser Black-backed Gull - Pemberton (1963) and the Black-headed Gull - Pemberton (1963). The only Welsh record is that of Davies, who found the species in four out of eleven Herring Gull at New Quay, Cardiganshire. The writer found a single immature strobila in a Great Black-backed Gull shot at Saundersfoot, Pembrokeshire in March, 1961.

Description.

The strobila was 1.8 mm. long and only the final three segments were sufficiently mature for the testes to be estimated. In the final segment, 0.672 mm. wide by 0.24 mm. long, there were 34 testes. (Figure 36).

The scolex is 0.512 mm. broad and bears the expected pairs of bothridia, two dorsal and two ventral, which are 0.41 mm. long and 0.25 mm. wide. Each has an extremely well-developed auricle at the anterior end.

Discussion

Despite the immaturity of the specimen, the possession of the well-developed auricles and more than thirty testes makes it evident that it should be classified as Tetrabothrius erostris (Lönnberg, 1889).

The Great Black-backed Gull (Larus marinus L.) is a new British host record.

4). Tetrabothrius immerinus (Abildgaard, 1790) Baer, 1954.

syn. Taenia immerinus Abildgaard, 1790.

Tetrabothrius macrocephalus (Rud., 1810) Rud., 1819.

Tetrabothrius junceus (Baird, 1862).

Tetrabothrius articus (von Linstow, 1901).

Tetrabothrius lobatus (von Linstow, 1905).

Terabothrius perfidus Joyeux and Baer, 1934.

Tetrabothrius rostratulae Yamaguti, 1940.

Paratetrabothrius orientalis Yamaguti, 1940.

Abildgaard (1790) described Taenia immerinus in the Great Northern Diver (Gavia immer Brünnich) from an unknown locality.

Baer (1954) in a discussion on the synonymy, anatomy and distribution stated that T. macrocephalus (Rud., 1810) Rud., 1819 is a synonym so that Tetrabothrius immerinus becomes the genotype. The species has been recorded throughout the world in fish-eating hosts amongst which should be mentioned the Black-throated Diver (Gavia arctica (L.), the Red-throated Diver (Gavia stellatus Pont.), the Great Crested Grebe (Podiceps cristatus (L.), the Slavonian Grebe (Podiceps auritus (L.)), the Red-necked Grebe (Podiceps griseigena (Boddenot)), the Kittiwake (Rissa tridactyla (L.)), and the Common Guillemot (Uria aalgae (Pont.)).

The first British records in the Red-throated Diver are those of McIntosh and Nicoll (1927), Baylis (1928) and Baylis (1939). Baylis (1939) added the Black-throated Diver to the British host list, while Beverly-Burton (1964) found the cestode in the Great Northern Diver in St. James' Park, London.

A single incomplete specimen from the intestine of a Great Crested Grebe, the corpse of which was sent to the writer, was

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Plate 24

Tetrabothrius immerinus (Abildgaard, 1790)

Figure 37. Scolex. L.P. X 10.

Figure 38. Mature segment. H.P. X 2.

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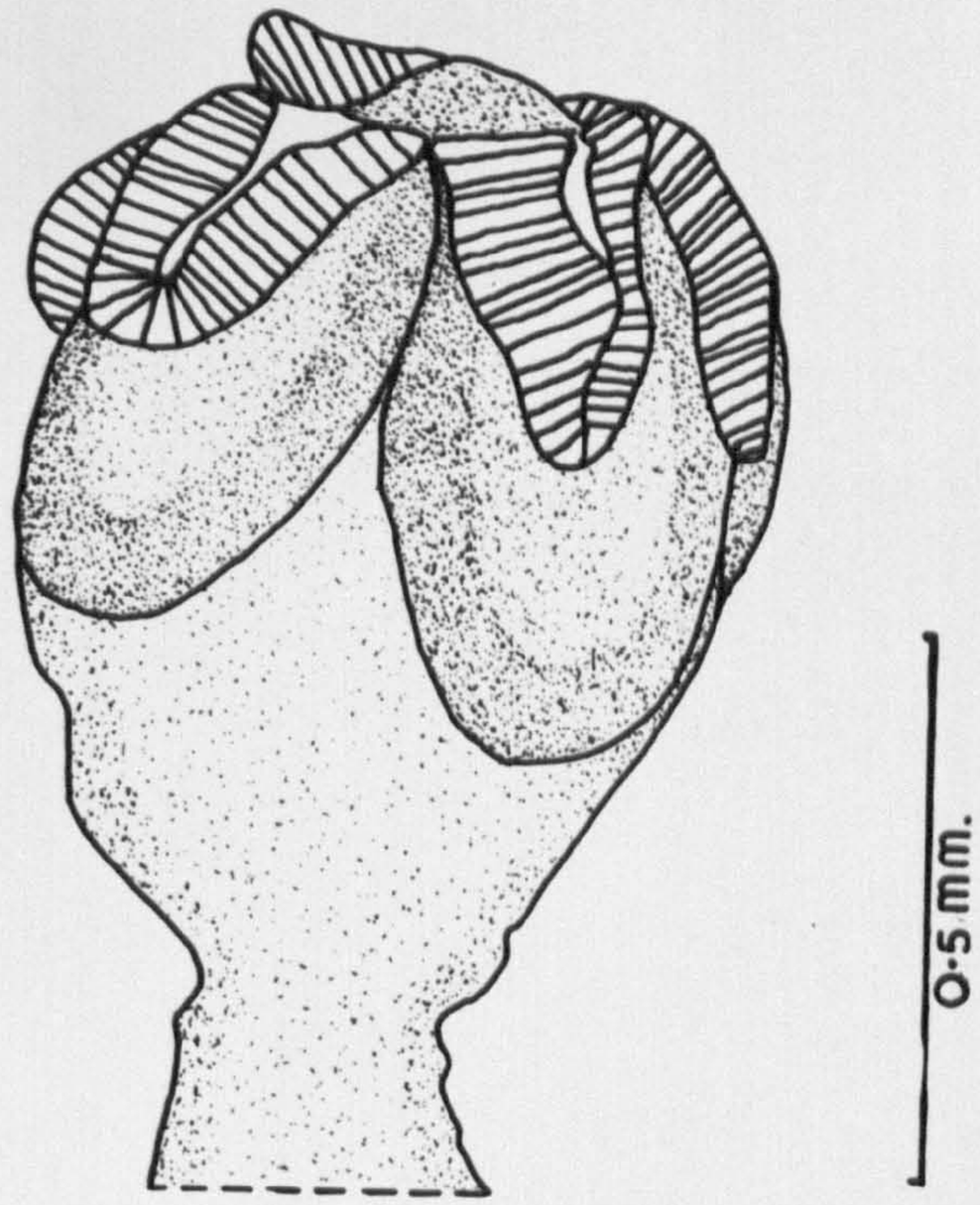

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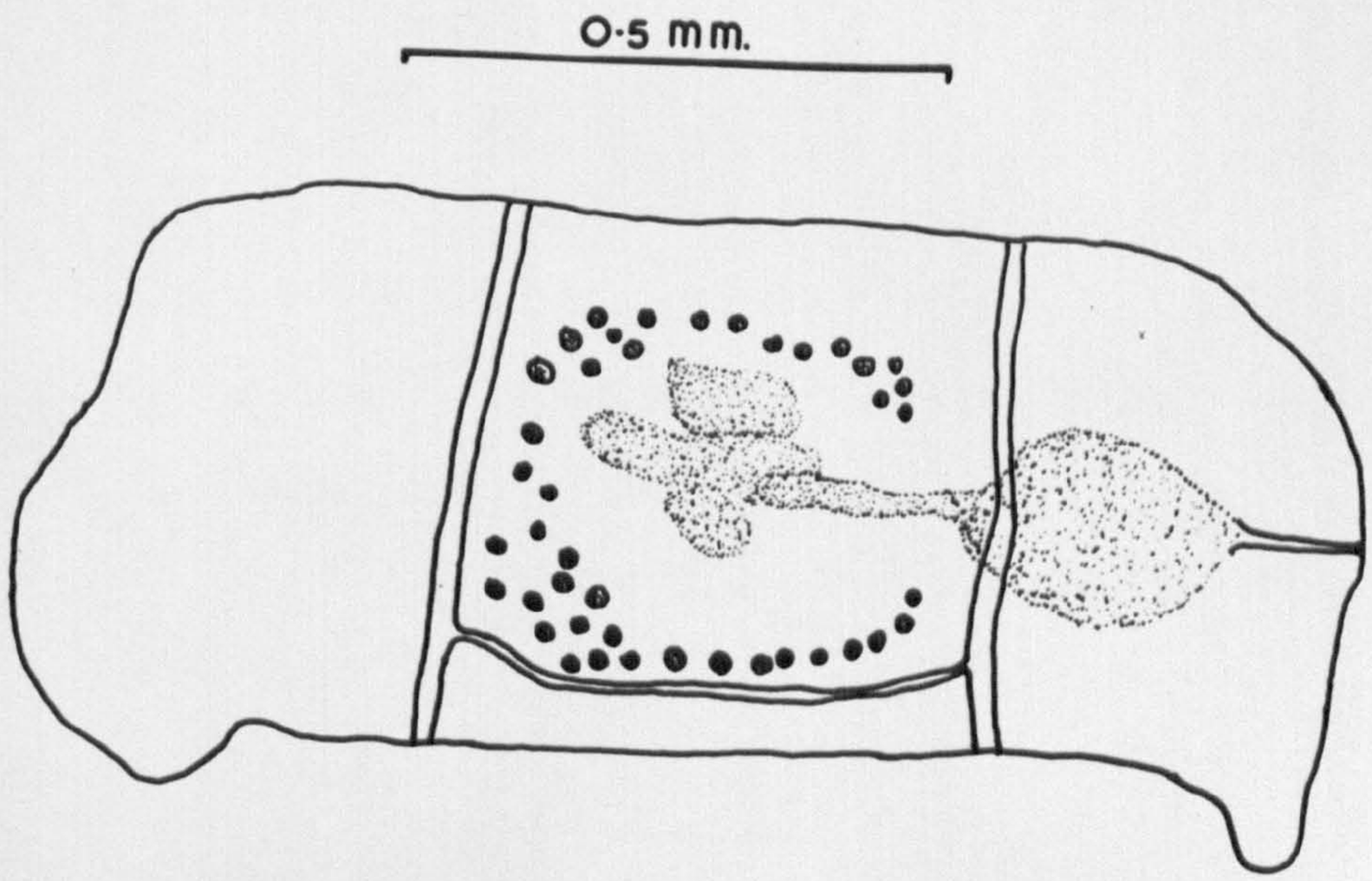

recovered in January, 1961.

Description.

The strobila was a deep faun in colour and 2.8 mm. long. The scolex is comparatively large, 0.852 mm. long and 0.66 mm. wide while the four bothridia are 0.508 mm. long and 0.284 mm. wide. There are four very large auricles overlapping the anterior end of the bothridia. (Figure 37).

The neck is 0.284 mm. wide and the genitalia are patent by the fortieth segment. The most mature segment is 0.17mm. long and 0.51 mm. wide. The female genitalia, the cirrus pouch and the genital atrium are not fully differentiated but some 42 small testes are observable as a continuous row around the female system, within the excretory ducts. (Figure 38). In this segment the ventral excretory vessel is 0.012 mm. wide and the dorsal vessel 0.004 mm. wide. The genital pores are seen to be unilateral and the primordia of the undifferentiated cirrus pouch and vagina pass between the excretory ducts.

Discussion.

This text, short as it is, is in agreement with the scolex size and testes number given by Joyeux and Baer (1934) for T. perfidus. This species is recognised by Baer (1954) as a synonym of T.immerinus (Abildgaard, 1790).

The cestode has not previously been recorded from the Great Crested Grebe (Podiceps cristatus (L.)), in Britain.

Order - CYCLOPHYLLIDEA Ben. in Braun, 1900.

Family: DAVAINEIDAE Fuhrmann, 1907.

S. F: Davaineinae Braun, 1900.

Genus: Raillietina Fuhrmann, 1920

syn. Johnstonia Fuhrmann, 1920.

Meggittia López-Neyra, 1929.

Idiogeoides López-Neyra, 1929.

Kotlania López-Neyra, 1929.

Brumptiella López-Neyra, 1929.

The family Davaineidae was erected by Fuhrmann, (1907) with three sub-families, Ophryocotylinae, Idiogeniae and Davaineinae. This last sub-family contained only three genera, Davainea Blanchard, 1891, Cotugnia Diamare, 1893, and Polycelia Fuhrmann, 1907. In 1909 Railliet et Henry supressed Polycelia into synonymy with Porogynia.

Fuhrmann (1920) revised the subfamily and erected two new genera, Davaineoides and Houttuynia but there remained some 113 species for which he created the genus Raillietina. He divided this genus into four sub-genera - Ransomia (type - Dav. tetragona (Molin, 1858)), Paroniella (type - Dav. longispina Fuhrmann, 1908), Johnstonia (type - Dav. echinobothrida (Megnin, 1881)) and Skrjabinia (type - Dav. cesticillus Molin, 1858).

In 1923, Joyeux redescribed Dav. echinobothrida (Megnin, 1881) and transferred it to the genus Ransomia. Stiles and Orleman (1926) placed the remaining species of the sub-genus Johnstonia as Fuhrmanetta with Taenia crassula Rudolphi, 1819 as the type species. They were critical of Fuhrmann's contravening Rule 30 of the

International Rules of Zoological Nomenclature in which one sub-genus must carry the generic name and assigned Raillietina for the sub-genus Ransomia again with Dav. tetragona (Molin, 1858) as type.

The subgenus Skrjabinia is characterised by irregularly alternating genital pores and uterine capsules each with a single egg.

Raillietina (Skrjabinia) Fuhrmann, 1920.

syn. Brumptiella López-Neyra, 1929 ex parte.

Meggittia López-Neyra, 1929 ex parte.

5). Raillietina (Skrjabinia) bonini (Megnin, 1899) Fuhrmann, 1920

syn. Taenia bonini Megnin, 1899.

Megnin, (1899) described Taenia bonini from the Woodpigeon (Columba palumbus L.) It has been recorded from the same host in Europe on many subsequent occasions. The first British record is from Davies (1937, unpubl.) and since then (Evans 1938, unpubl.), Baylis (1939) and Mettrick (1958) have also recovered the cestode from this host.

The writer has found this species in nine out of forty-three Woodpigeons but only between the middle of August and the end of November, the pigeons shot at other times of year being entirely free of the cestode. A single Stock Dove (Columba oenas L.) given, dead, to the writer from a farm near Neyland, Pembrokeshire, had three immature strobila. It was possible to recognise the species by the distinctive hooks on the scolex and the irregularly alternated genital pores.

External Morphology

The off-white cestodes are found in the small intestine and their length varies greatly according to whether the infestation is heavy or not. The maximum length recorded was 98 mm. in a light infestation - about ten specimens - while in a heavy infestation - thirty to forty specimens - it rarely exceeds 60 mm. The maximum width recorded, in a gravid segment, was 0.77 mm.

The small scolex (Figure 39) has an average diameter of 0.189 mm. and a length of 0.165 mm. It narrows sharply behind the four suckers to form the neck, 0.105 mm. The rostellum is small and bears a double row of hooks approximately 0.01 mm. long. The hooks have a characteristic shape illustrated in Figure 40. The diameter of the rostellum is 0.05 mm. and the cup-shaped rostellum sac is 0.04 mm. long. The four suckers are 0.055 mm. in diameter and bears a mass of tiny hooks which are directed inwardly to the centre of the sucker and are crook-shaped, (Figure 39).

Internal Morphology

The genital pores alternate irregularly and open in the anterior half of the segment. They are thin-walled and vesicular, 0.05 - 0.068 mm. deep.

a) Excretory system

The excretory system follows the pattern typical of the Cyclophyllidea. The small dorsal vessels are 0.014 - 0.018 mm. in diameter, and the ventral vessels are 0.05 mm. in diameter. The ventral vessels are connected by a posterior transverse vessel, 0.008 mm. in diameter.

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Plate 25

Raillietina (Skrj.) bonini (Megnin, 1899)

Figure 39. Scolex. H.P. X 10.

Figure 40. Hook a) rostellum. Oil

b) sucker. Oil

Figure 41. Gravid segment. L.P. X 6.

Figure 42. Mature segment. H.P. X 2.

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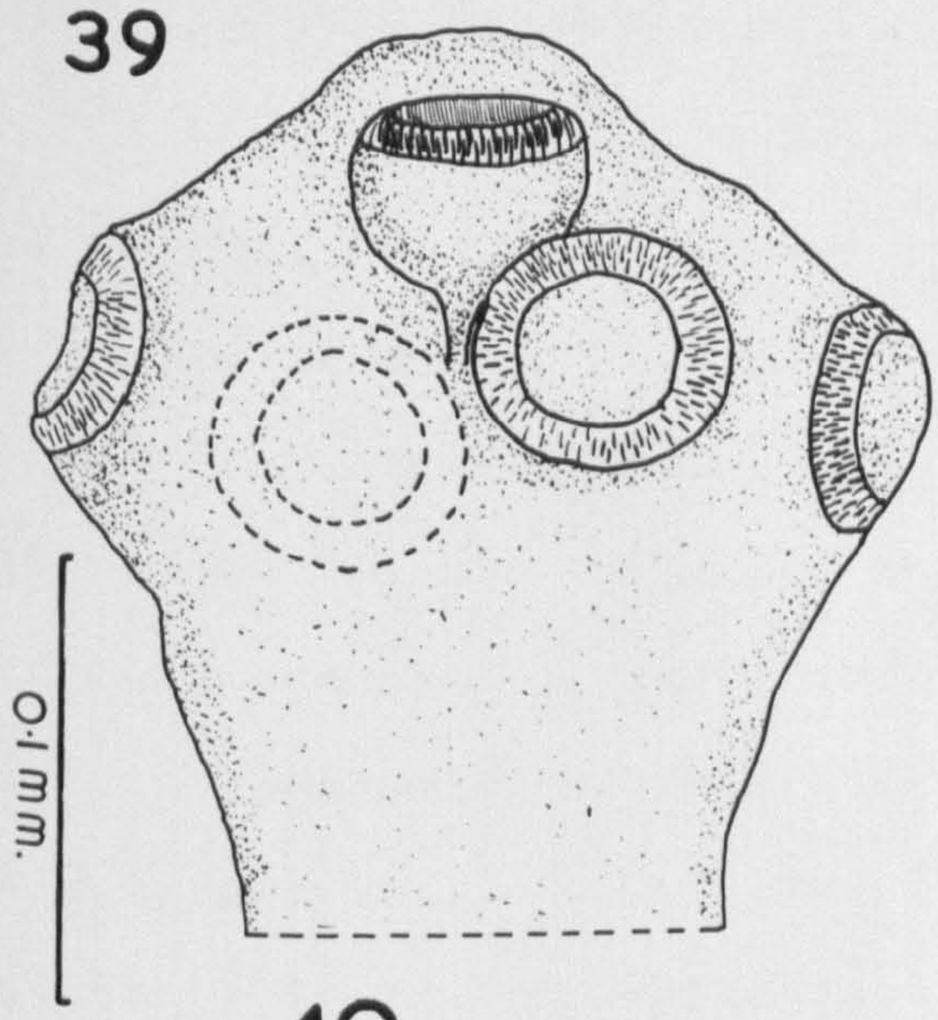

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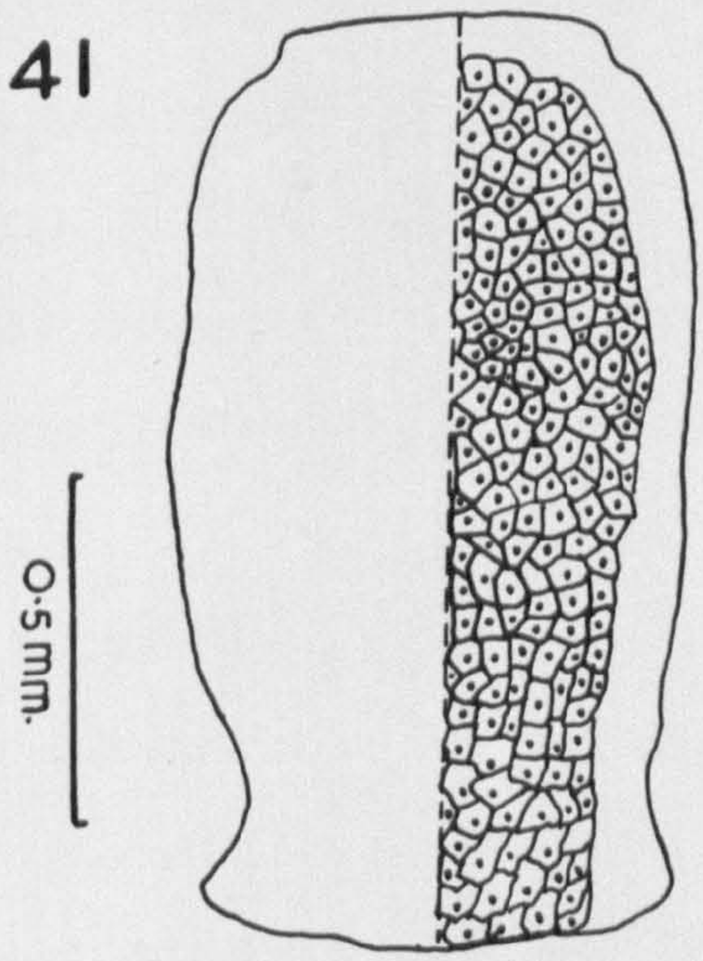

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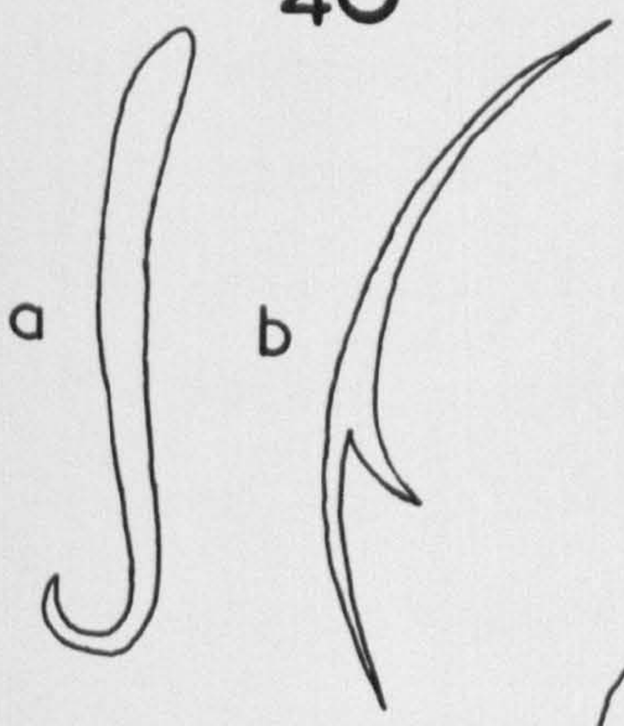

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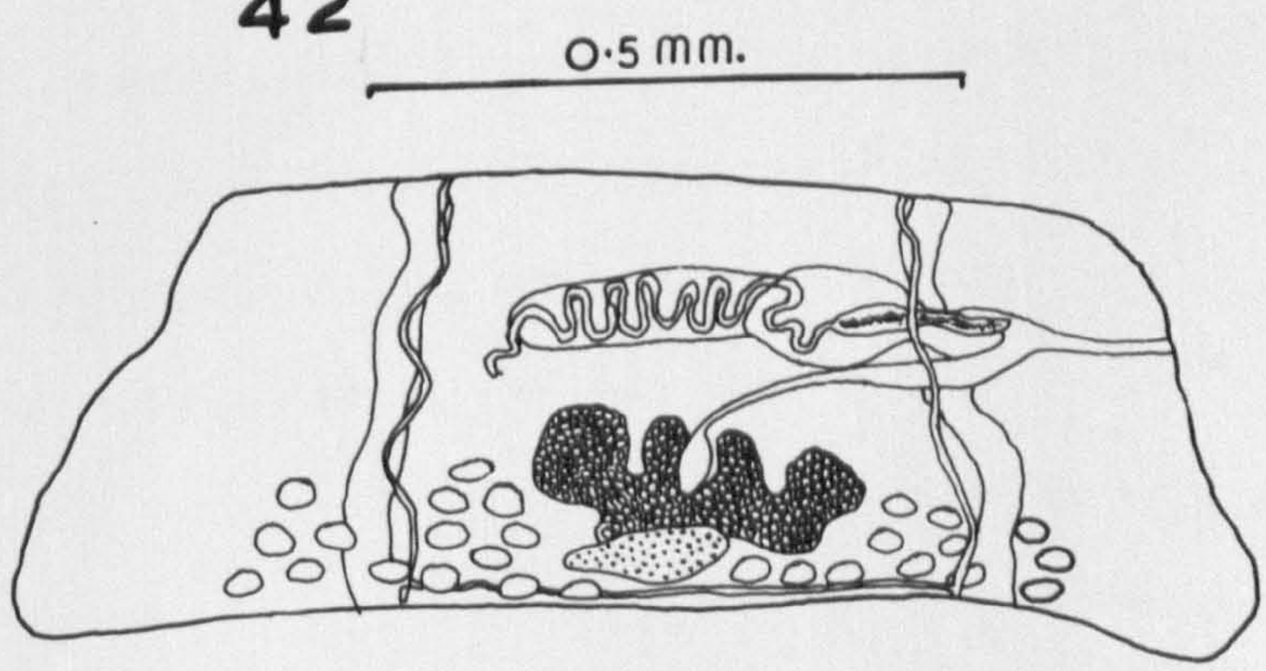

b). Reproductive system

The genital primordia are patent by the 75th. segment, both sets of organs developing simultaneously. In a mature segment, 0.76 mm. long and 0.245 mm. wide there are 22 - 30 testes, 0.04 mm. in diameter which extend beyond the excretory canals at each side (Figure 42). The cirrus sac is in the anterior half of the segment and is up to 0.205 mm. long. The posterior half, 0.165 mm. long and 0.05 mm. wide, contains the internal seminal vesicle which continues into the cirrus itself. The cirrus was not found everted but within the sac is 0.115 mm. long. It is finely spinose.

The vaginal opening is posterior to that of the cirrus sac and in the immature specimens is very large and sac-like. It is thick-walled and 0.17 mm. long. It opens into the ovoid receptaculum seminis, which is in the mid-line of the proglottid in the posterior half between the ovarian lobes. It is 0.065 mm. by 0.038 mm. The ovary is bipartite in the posterior half of the proglottid and each half is irregularly lobed. The diameter of the ovary in a typical segment is 0.23 mm. Posterior to the ovary is the ovoid vitelline gland, 0.103 mm. by 0.046 mm.

A typical gravid segment measures 1.332 mm. by 0.7 mm. and is packed with egg capsules, each 0.06 - 0.09 mm. in diameter and containing a single ova, (Figure 41). The ova are 0.035 mm. in diameter and the embryonic hooks are 0.015 mm. long

Discussion.

The text above shows compatibility with previous accounts, the most recent being that of Mettrick (1958).

The Stock Dove (Columba oenas L.) is a new host record.

S.F. Ophryocotylinae Fuhrmann, 1907.

Genus: Ophryocotyle Friis, 1870.

The genus was created by Friis in 1870 to include a cestode Ophryocotyle proteus Friis, 1870. A further ten species have been added to this genus but Burt (1962) in his reassessment of the genus synonymised some of these species and transferred others to different genera, so that the genus now includes only five of the previous species and a sixth, O. prudhoei Burt, 1962. The characters for the genus are Ophryocotylinae species with a large rostellum bearing an undulating double row of small hooks, four suckers armed with spines, sexual pores irregularly or regularly alternating and a lobed, sac-shaped uterus.

6). Ophryocotyle insignis Lönnberg, 1890

syn. O. alaskensis Webster, 1949

Ophryocotyle insignis was described from the Oystercatcher (Haematopus ostralegus L.) from the West Coast of Norway. There are various records from the Redshank (Tringa totanus (L.)), and the Sanderling (Crocethia alba (Pallas)). The first British record comes from Davies (1937, unpubl.) in the Bar-tailed Godwit (Limosa lapponica (L.)) - from Norfolk, while Williams (1962) and Burt (1962) have both found it in the Oystercatcher at Aberystwyth and Gower, and Fife respectively.

The writer has found it in five out of eleven Oystercatchers obtained in Southern Pembrokeshire (1 - 7/60, 2 - 10/60, 1 - 7/61, 1 - 9/62). The worm burden varied from between twenty and thirty in the late summer months to two to four per bird when shot at the end of October. Some sixty specimens were collected all told

External Morphology

The cestodes are a deep yellow in colour, particularly when contracted. They are extremely active and were kept alive with their scolices embedded in a length of gut wall for some five - six days. Great difficulty was experienced in collecting the cestodes in a sufficiently relaxed state and in particular there was a tendency for the rostellum to be inverted in the scolex. The cestodes vary from 10 mm. to 75 mm. though some of these latter specimens were contracted and may attain 100 mm., as recorded by Lönnberg. The maximum width was 2.7 mm.

The maximum diameter of the scolex is 0.36 mm. and the length is about 0.21 mm. The rostellum is smaller, with a diameter of 0.255 mm. (Figure 43). The double row of hooks (Figure 44) is arranged in 14 - 16 loops. The hooks are of two sizes, the larger anterior row measuring 0.009 mm. and the smaller posterior row, 0.006 mm. The four suckers were ovoid and somewhat flattened in all the specimens, 0.95 - 0.115 mm in diameter, each bearing a crescent of curved spines on the anterior border approximately 0.009 mm. long

Internal Morphology

The primordia are patent by the 45th segment. The mature proglottid is wider than long, 0.43 mm. by 0.714 mm. and the genital apertures, which are irregularly alternated, are situated in the anterior quarter.

a) Excretory system

The excretory system consists of the usually ventral longitudinal vessels (0.045 mm. in diameter) and dorsal longitudinal vessels (0.015 mm. in diameter). The genital ducts

are dorsal to both excretory ducts.

b) Reproductive system

There are 50 - 80 testes which extend throughout the proglottid and lie two to three deep (Figure 45). Their average diameter is 0.06 mm. The cirrus sac lies dorsal to the excretory vessels and is oval, 0.09 mm. by 0.13 mm. The cirrus is covered with minute spines and is 0.105 mm. long when extended. The vas deferens which is continuous with the sac is 0.025 mm. in diameter.

The lobed ovary is on the ventral side of the proglottid and extends almost to the excretory ducts at each side, its diameter being at least 0.5 mm. in the mature proglottid. There are about 20 lobes. The vitelline gland is more regular in outline and dorsal to the ovary, 0.15 mm. by 0.3 mm. The shell gland is slightly anterior to and at the same level as the vitelline gland, 0.6 mm. in diameter. The vagina opens from the genital atrium and runs dorso-ventrally alongside the cirrus sac before entering the large receptaculum seminis, which is 0.1 mm. by 0.05 mm.

The uterus completely fills the proglottid between the excretory vessels and is sac-shaped. It contains numerous onchospheres 0.04 mm. in diameter. The embryos are 0.025 mm. on average and the hooks are of two sizes - the large median pair are 0.0175 - 0.0195 mm. long, and the lateral pairs 0.015 mm. long.

Discussion

The material obtained agrees reasonably well with Fuhrmann (1909) and Mahon (1954), both of whom redescribed Lönnberg's original material. Burt (1962) states 14 loops on the head-crown, while Fuhrmann gives 28 - 30 and Mahon 24 - 26. The writer

found 14 - 16 and as some of these are "half" loops due to the incomplete relaxation of the rostellum, it is safe to assume that 14 loops as stated by Burt is the exact number in a fully relaxed specimen. Fuhrmann (1909) stated 100 testes but Mahon (1954) estimated only 40. Burt (1962) records 60 - 70, while the writer has found 50 - 80. The principal difficulty is that the testes are two or three deep within the proglottid. One can say with certainty however that there are more than 40 but less than 100.

Mahon (1954) suggested that O. alaskensis Webster, 1949, is a synonym of O. insignis Lönnberg, and Burt (1962 has confirmed that this is so.

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Plate 26

Ophryocotyle insignis Lönnberg, 1890

Figure 43. Scolex. H.P. X 10.

Figure 44. Hook a) rostellum. Oil.

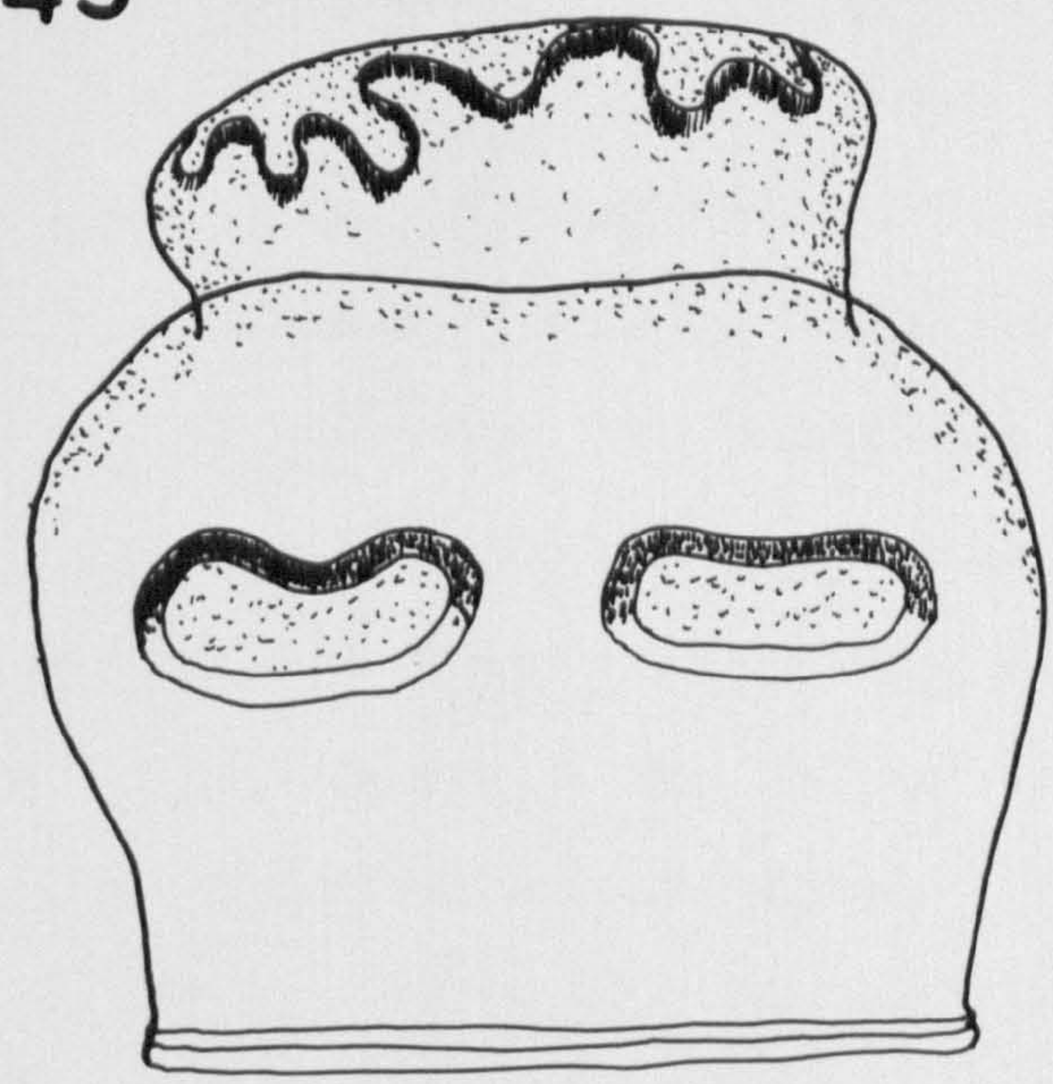
b) sucker. Oil.

Figure 45. Mature segment. L.P. X 6.

Ophryocotyle proteus Friis, 1870

Figure 46. Scolex. H.P. X 6.

43



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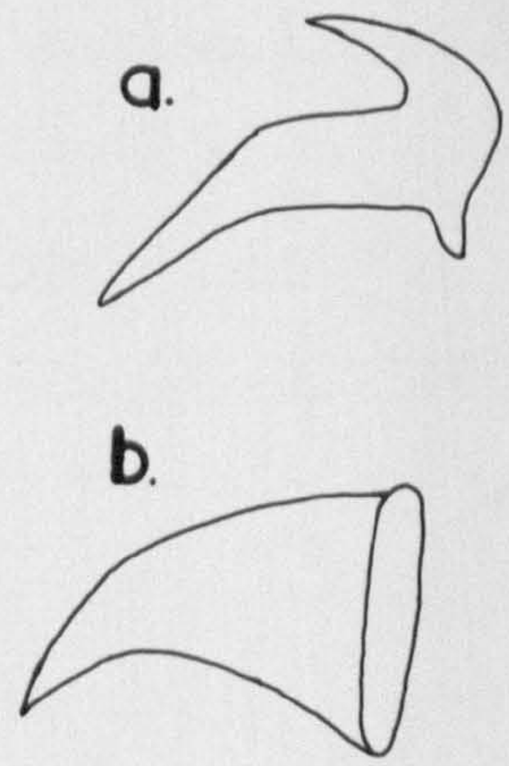

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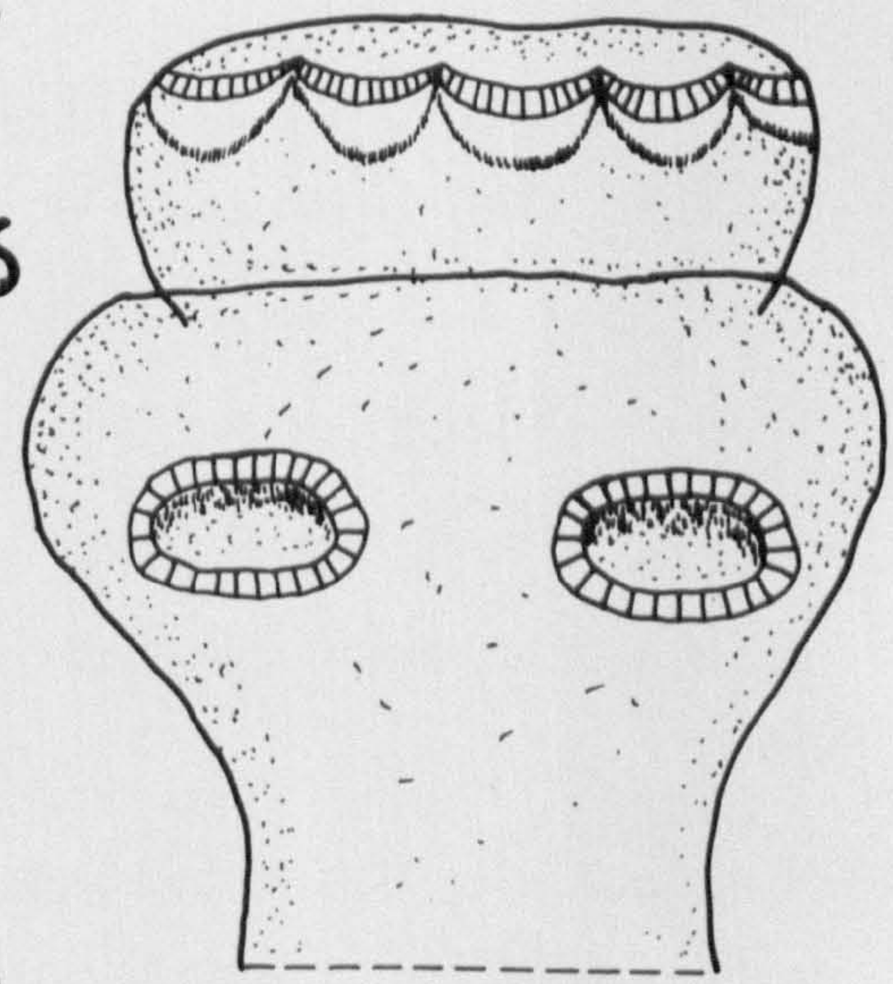
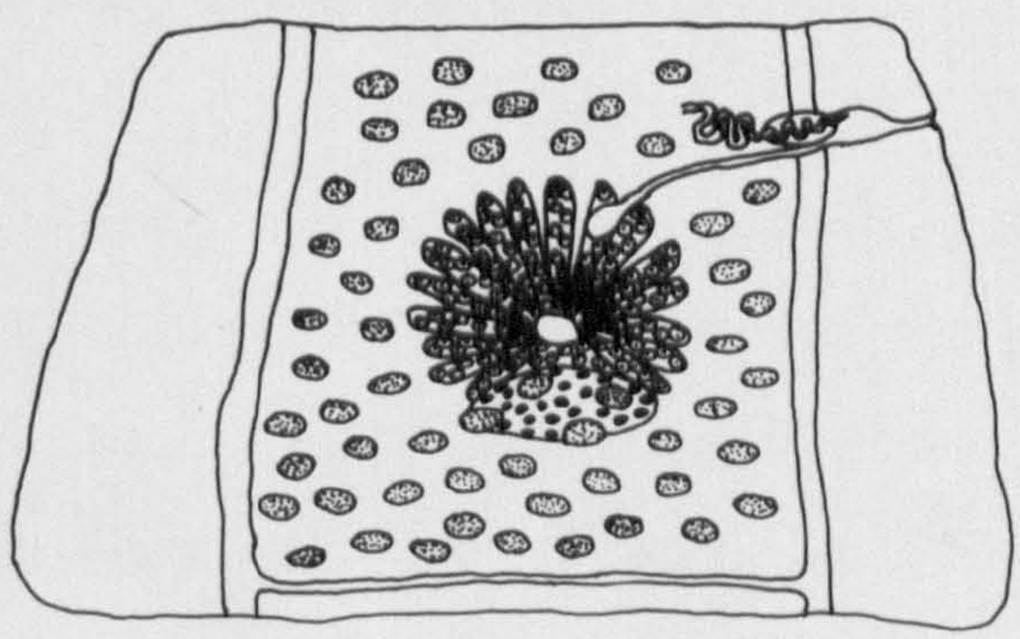


0·1 mm.

45

0·5 mm.



7). Ophryocotyle proteus Friis, 1870.

Syn. O. lacazii Villot, 1875.

Friis (1870) described O. proteus from the Dunlin (Calidris alpina L.), the Ringed Plover (Charadrius hiaticula L.) and the Common Gull (Larus canus L.). Villot (1875) described a second species O. lacazii in the Bar-tailed Godwit (Limosa lapponica L.) at Rossoff, but Blanchard (1891) considered it to be a synonym of proteus. Villot recorded the Turnstone (Arenaria interpres L.) and Linton (1927) added the Herring Gull (Larus argentatus Pont.) and the Laughing Gull (Larus atricilla L.) to the list of hosts.

Davies (1937, unpubl.) and Walker (1937) both recorded the cestode in the Dunlin at Aberystwyth. Baylis (1939) found the species in a Bar-tailed Godwit in Norfolk and Williams in the Ringed Plover and the Oystercatcher (Haematopus ostralegus L.) again at Aberystwyth. From Fife comes a new host, the Redshank (Tringa totanus (L.)) recorded by Burt (1962) and the Bar-tailed Godwit and Dunlin are also parasitized in this region.

The writer found a single strobila in a Herring Gull (December, 1960) shot on pasture in Saundersfoot, Pembrokeshire.

Description.

The cestode was immature, about 6 mm. long and composed of about thirty proglottids in none of which were the genitalia differentiated. The scolex is 0.4 mm. in diameter and its length, including the rostellum, is 0.290 mm. (Figure 46). The diameter of the rostellum is 0.329 mm. The musculature of the rostellum forms five lappets on each side. The loops of the rostellar spines are difficult to estimate but there are

approximately sixteen. The hooks are characteristic in shape and about 0.006 mm. long in a double row. Each of the four suckers bears about 70 larger spines (0.01 mm.) which are rose-thorn shaped and backwardly directed. They surround the anterior and lateral side of each sucker. The neck is about 0.3 mm. long.

Discussion.

O. proteus has not previously been recorded from the Herring Gull in Europe. Burt (1962 suggests that the nature of the intermediate host (Nereis diversicolor) makes it unlikely that gulls would become infested with this species. The description above is closely akin to existing descriptions of the species. Burt states that of 136 gulls examined in Scotland and Wales not one was infected. The writer found only the single strobila in 33 Great Black-backed Gulls, 9 Lesser Black-backed Gulls, 17 Herring Gulls, 5 Common Gulls and 3 Blackheaded Gull. Pemberton (1963) found the species in 5 out of 146 Blackheaded Gulls. Thus out of 349 gulls examined in the last five years only 6 birds have been hosts for this species.

Family: DILEPIDIDAE Railliet et Henry, 1909.

syn. Dilepinidae Fuhrmann, 1907.

The Cyclophyllid family Dilepinidae was created by Fuhrmann in 1907. In 1909, Railliet et Henry utilized the name Dilepididae and Fuhrmann (1932) acknowledged this latter name due to the lapse of Dilepinidae. Yamaguti (1959) has correctly given the former name as a synonym. Sprehn (1932) gives Luhe's family name Dipylidiidae (1910) as a synonym.

Sub-family: Dilepidinae Fuhrmann, 1907.

Genus: Dilepis Weinland, 1858.

The genus Dilepis was erected by Weinland in 1858, with D. undulata (Rud., 1810) as type. Mettrick (1958) has stated 1834 as the year in which Weinland created Dilepis but failed to supply a reference. The writer has been unable to trace a paper by Weinland for the year, 1834, so one must assume that this is an error on Mettrick's part.

8). Dilepis undula (Schrank, 1788) Weinland, 1858.

syn. T. undula Schrank, 1788.

T. serpentiformis non collaris Goeze, 1782.

T. undulata Rudolphi, 1810.

T. angulata Rudolphi, 1810.

D. angulata (Rud., 1810) Dujardin, 1845.

D. angulata (Rud., 1810) Leidy, 1887.

Hymenolepis pyramidis Sinitzin, 1896.

D. angulata (Rud., 1810) Cohn, 1899.

Hymenolepis undulata (Rud., 1810) Parona, 1899.

D. undulata Voltz, 1900.

D. brachyarthra Cholodowsky, 1906.

Drepanidotaenia undula (Schrank, 1788) Rosseter, 1906.

Southwellia ransomi Chapin, 1926.

Dilepis turdi Yamaguti, 1935.

Schrank (1788) described T. undula from various birds of the family Corvidae. Rudolphi (1810) renamed it T. undulata and described a further similar species T. angulata. This latter species has been synonomised with undulata and to accord with the International Rules for Zoological Nomenclature, Fuhrmann (1908) changed the name to Dilepis undula. The species has been listed and redescribed under the various names given above. The life history and presence of the larva in the earthworm was established by Vogel (1921) and confirmed by Harper (1923).

The many hosts, most of which are Passerine birds, are too numerous for inclusion. From Britain alone come the following records: the Rook (Corvus frugilegus L.) Davies, 1935, Evans 1938 (unpubl.),Baylis, 1939, Mettrick,1958, Williams, 1962; the Carrion Crow (Corvus corone corone L.), Baylis, 1928, Walker, 1937, Evans 1938 (unpubl.), Mettrick, 1958; the Jackdaw (Corvus monedulus L.) Baylis, 1928, Mettrick, 1958; the Magpie (Pica pica (L).), Mettrick, 1958; the Jay (Garrulus glandarius (L).) Davies, 1939, Mettrick, 1958; the Starling (Sturnus vulgaris L.), McIntosh and Nicoll, 1927, Baylis, 1928, Walker 1937, Davies 1937 - (unpubl.), Evans , 1938 (unpubl.), Baylis 1939, Mettrick 1958; the Fieldfare (Turdus pilaris L.) Bellingham 1844, Baylis, 1939, Mettrick 1958; the Missel Thrush (Turdus viscivorus L.) Baylis 1928, Baylis 1928, Baylis 1939, Mettrick 1958; the Songthrush (T. melophilos clarki

Hartert), Bellingham 1844, Baylis 1928, Evans 1938 (unpubl.), Baylis 1939, Mettrick 1958, Williams 1962; the Blackbird(T.merula L.) Bellingham 1844, Baylis 1928, Davies 1935, Baylis 1939, Mettrick 1958; the Redwing (T. musicus L.) Baylis 1939; Hedge sparrow (Prunella modularis (L).) Mettrick 1958; the House sparrow (Passer domesticus (L).) Mettrick 1958; the Coal tit (Parus ater britannicus Sharpe & Dresser) Mettrick 1958; the Blue tit (Parus caerulus L.) Mettrick 1958; the Common Gull (L. canus L.) Williams 1962; the Herring Gull (L. argentatus Pont.) Pemberton 1963; the Black-headed Gull (L. ridibundus L.) Pemberton 1963 and the Lesser Black-backed Gull (L. fuscus L.) Pemberton 1963.

The writer has found Dilepis undula in the following hosts: the Raven (Corvus corax L.) three scolices in two birds, March 1963; the Carrion crow - ten out of five birds shot 8/60, 12/60, 1/62, 7/62, 1/63; the Rook, 29 out of 11 birds at all times of the year from 8/60 to 6/63; the Magpie - 8 out of 3 birds 1/61, 7/61, 6/62; the Jay - 2 out of 2 birds, 12/62, 3/63, the Starling - numerous in at least 100 birds during the winter months of 1960, 1961, 1962, 1963; the Fieldfare - 8 out of 5 birds 3/63; the Songthrush - 5 out of 2 birds 1/61, 6/63; the Blackbird - 12 out of 4 birds 11/60, 4/61 1/62, 3/63; the Redwing - 5 out of 2 birds - 3/63; the Hedge sparrow - 1 out of a single bird 7/62 and the Herring Gull - 1 from a single bird, 12/61. The starlings and corvid birds were obtained throughout Pembrokeshire, the remainder were taken in the south of the County.

Fifteen of the cestodes were stained and mounted and a further three were sectioned.

External Morphology.

The cestodes are a creamy white and in the smaller birds extend throughout most of the intestine. The maximum length was 68 mm. from the Raven, while the smallest was from the Herring Gull - 7 mm. The maximum width in a relaxed specimen was 3.5 mm., but in contracted specimens recovered from frozen starlings, 5 - 7 mm. was not unusual.

The scolex is prominent and wider than long, the diameter measuring 0.43 - 0.85 mm. in the various specimens. The armed rostellum bears a variable number of hooks, 48 - 62, arranged in a double row. The average length for the anterior row is 0.1 mm., and for the posterior row, 0.082 mm. Williams (1956 - unpubl.) has given evidence of a constant size in the hooks of the species from the Rook, Songthrush and the Herring Gull, but no similar consistency has been discovered by the writer. The muscular suckers are 0.27 mm. in diameter.

The neck is both short and narrow, 0.55 - 0.596 mm. by 0.495 - 0.642 mm. There is a gradual widening of the strobila towards the posterior end, which is bluntly rounded and bears the open ends of the excretory vessels. In some ten mounted specimens, the immature region was found to consist of 50 - 70 segments (0.27 by 0.77 mm.). The mass of the strobila was composed of mature segments (0.3 mm. by 1.278 mm.) while the ultimate 20 - 43 segments were gravid, (0.405 mm. by 1.58 mm.).

Internal Morphology

a). Musculature.

There are no prominent circular or transverse muscles and the gross musculature comprises two longitudinal muscle which are continuous from segment to segment and completely surround the medula. Voltz (1900) considers the outer layer only to be complete, but Nietsche (1873), Davies (1935) and Mettrick (1959) all record an arrangement identical with the writer's material. The muscle fibres number 9 - 14 per bundle.

b). Excretory System.

The customary dorsal and ventral pairs of vessels are displayed. The dorsal vessels show a slight variation in size, in that those on the right-hand side are smaller, 0.009 - 0.011 mm., as opposed to 0.008 - 0.014 mm. Davies (1935) interprets this as being due to the opening of the genital ducts on the right side. The ventral ducts also show some disparity in size, 0.035 - 0.04 mm., and continue throughout the strobila, while the dorsal pair atrophy in the gravid region.

c). Reproductive System.

The unilateral pores open on the right side which is in agreement with Rosseter (1906), Davies (1935) and Mettrick (1958). Voltz (1900) states that the pores in his specimens open on the left side of the strobila. The pore itself is found in the anterior half of each segment.

(1) Male - the analagen of the cirrus sac is evident by the 43rd. segment. In a mature segment there are 30 to 33 oval testes several layers deep, behind the ovary and the vitelline gland.

They are wider than long in most of the stained specimens (0.05 - 0.056 mm. by 0.062 - 0.068 mm.) and restricted to the inter-vascular region. The narrow vasa efferentia join to form the vas deferens which runs forwards somewhat irregularly to enter the long, narrow cirrus sac. The largest sac in any specimen was 0.53 mm. by 0.048 mm., while the average size is 0.428 mm. by 0.038 mm. The cirrus can be everted for up to 0.35 mm. and is seen to be armed with minute spines. It is 0.011 mm. in diameter and is dorsal to the excretory ducts on the right side.

(ii) Female - the vagina and receptaculum seminis are patent by the 60th. segment and the ovary is evident by the 75th. segment. The vagina runs parallel with, but dorsal and slightly anterior to, the cirrus sac. It has a diameter of 0.015 mm. and after passing over the excretory canals, it curves posteriorly to enter the receptaculum seminis, (0.03 mm. by 0.06 mm.). A posteriorly directed duct joins the common oviduct before entering Mehlis' gland which is dorsal in position (0.085 mm. by 0.03 mm.)

The ventral ovary is composed of two groups of irregularly distributed follicles and is anterior to both the testes and the vitelline gland. It is up to 0.04 mm. across and the right hand group is seen to consist of fewer follicles (8 - 12) than the left hand group (14 - 21). The right hand group is posterior to the cirrus sac and the vagina.

The compact vitelline gland may be found to be right or left of the midline. It is slightly lobed and 0.05 mm. long by 0.078 mm. broad. The vitelline duct opens ventrally into Mehlis' gland, from the anterior end of which the uterine duct arises and

TABLE: 20 Dilepis undula (Schrank, 1788)

Characters		Davies, 1935	Mettrick, 1958	Author
Length of strobila		50.0	70.0	68.0
Maximum breadth		2.5	3.5	3.5
Scolex	Diameter	0.725	-	0.43 - 0.85
Rostellum	Length	-	-	0.616
	Breadth	-	-	-
	Bulb diameter	-	-	0.221
Hooks	Number	45 - 60(2)	48 - 64(2)	48 - 62(2)
	Size	0.084/0.072	0.116/0.088	0.1/0.082
Suckers	diameter	0.245	-	0.198 x 0.256
Early Segment	Length	-	-	0.27
	Breadth	-	-	0.77
Mature Segment	Length	0.413	-	0.3
	Breadth	1.422	-	1.278
Gravid Segment	Length	0.34	-	0.405
	Breadth	1.65	-	1.58
Excretory	Dorsal	0.011 - 0.015	0.008 - 0.014	0.008 - 0.014
	Ventral	0.047 - 0.068	0.028 - 0.042	0.035 - 0.04
Genital atrium		Right	Right	Right
Testes	Number	28 - 35	28 - 36	30 - 33
	Size	0.062 - 0.066	0.048 - 0.063	0.056 - 0.066
Cirrus Sac	Length	-	0.28 - 0.42	0.428
	Diameter	0.034 - 0.035	0.032 - 0.044	0.033 - 0.038
Cirrus	Length	0.366	-	0.35
	Breadth	-	0.012 - 0.014	0.011
Vagina	Diameter	-	0.012	0.015
Receptaculum seminis		-	-	0.03 x 0.06
Ovary		0.029 - 0.042	0.028 - 0.04	0.04
Vitellaria		0.083 - 0.188	0.004 x 0.097	0.05 x 0.078
Envelope		-	0.04 - 0.048	0.045 - 0.053
Ova		-	0.036 - 0.04	0.036 - 0.04
Hooks		-	0.018 - 0.02	0.018 - 0.02

continues as a simple transverse tube. It extends beyond the excretory canals when gravid. The eggs are 0.036 - 0.04 mm. in diameter and the egg shells, 0.045 - 0.053 mm. The hooklets are 0.018 - 0.02 mm.

The uterus is persistent in all specimens examined and in most gravid segments traces of the cirrus sac and the receptaculum seminis remain.

Discussion.

Fuhrmann (1932) put Dilepis Weinland, 1858 in sub-family Dilepidinae Fuhrmann, 1907 because of the persistent uterus and both the published redescriptions from British material, which are given in Table 20 for comparison, agree with this. Chapin (1926), and Williams (1956 - unpubl.) consider that egg capsules are formed and that the genus should be placed in sub-family Dipylidiinae Stiles, 1896. None of the writer's material bears out this latter conclusion.

The Raven (Corvus corax L.) is a new British host record. The Magpie, Fieldfare, Redwing, Hedge Sparrow and the Herring Gull are all first records of Dilepis undula in these hosts for Wales.

Genus: Anomotaenia Cohn, 1900.

syn. Diplochetos (Linstow, 1906).

This genus was erected by Cohn with A. microrhyncha (Krabbe, 1869) as type. It is customary to follow Fuhrmann's classification and place the genus in the sub-family Dilepidinae Fuhrmann, 1907 because of the persistent uterus. López-Neyra (1951) re-described the type species as having a uterus which breaks down into egg capsules and as a result has proposed new generic definitions. The resultant implications are discussed more fully below at the end of the section on the Dilepids.

9). Anomotaenia constricta (Molin, 1858) Cohn, 1900

syn. T. constricta Molin, 1858.

T. gutturosa Giebel, 1866.

T. affinis Krabbe, 1869.

T. corinina Krabbe, 1869.

T. puncta Linstow, 1872.

Drepanidotaenia constricta (Molin, 1858) Parona, 1899.

Anomotaenia constricta (Molin, 1858) Lopez-Neyra, 1952.

Molin, (1858) described Taenia constricta from the Carrion Crow (Corvus corone corone L.). It has subsequently been recorded in Passeriformes throughout Europe, North America and Asia.

From Britain come the following records:-

Rook (Corvus frugilegus L.) Baylis (1928), Walker (1937) (Evans, 1938 unpubl.), Mettrick (1958); Carrion Crow - Baylis (1928, 1939), Mettrick (1958); Jackdaw (Corvus monedula L.) Mettrick (1958); Magpie (Pica pica L.)) Davies (1937, unpubl.), Pemberton (1960); Starling (Sturnus vulgaris L.) Mettrick (1958); Jay (Garrulus

glandarius (L.)) Mettrick (1958); Fieldfare (Turdus pilaris L.) Mettrick, (1958); Songthrush (Turdus philomelos clarkii Hartert) (Evans 1938), Baylis (1939), Mettrick (1958), Williams (1962); Redwing (Turdus musicus L.) Mettrick (1958); and the Blackbird (Turdus merula L.) Evans (1938 unpubl.), Baylis(1939), Mettrick (1958).

The previous Welsh records are those of Davies (1937,unpubl.), Walker (1937), Evans (1938 unpubl.) and Williams (1962) listed above. The author has recovered the cestode from the Carrion Crow (3 (1) - 7/61), the Jackdaw (2 (2) - 8/60, 12/61), the Songthrush (13 (1) - 8/63), the Blackbird (6 (2) - 1/62, 11/62) and the Redwing (3 (2) - 3/63).

Seven of the specimens were stained and mounted and a further strobila was sectioned.

External Morphology.

The white, medium size worms were found in the initial part of the small intestine. The length of the gravid worm varied from 7 mm. in the Blackbird to 53 mm. in the Songthrush in spite of the greater density of infection in this last host. The length would appear to be relative to the food supply since the Songthrush was shot in August while the Blackbirds were examined in November. The greatest diameter was 1 mm.

The scolex (Figure 47) is strongly developed with a diameter of 0.254 - 0.326 mm. This is considerably larger than Mettrick's figures (1958) - 0.04 - 0.05 mm., which are presumably misprints for 0.4 - 0.5 mm. The rostellum which bears a double row of hooks, is 0.215 mm. by 0.1 mm., with a bulb diameter of 0.106 mm.

The rostellar sac is 0.254 mm. long and 0.110 mm. across.

The number of hooks and hook size was not as variable as the descriptions of previous workers suggest. Volz (1900), who compared his material with the descriptions and material of Krabbe (1869), Molin (1858), von Linstow (1872) and Giebel (1866) states that there are 10 - 24 hooks measuring 0.026 - 0.063 mm. (!). Mettrick found 18 - 22 hooks which vary in length and size according to the host and the rostellar row, while the writer's material invariably bears 20 or 21 hooks in which the range in size and shape is clearly shown and is constant. For this determination all scolices were examined regardless of staining the strobila. The specimens from the Redwing and the Songthrush approximate to Mettrick's measurements from the Songthrush ((a) 45 - 52, (b) 42 - 45), and the Blackbird and Jackdaw material also corresponds to a degree which confirms the validity of Mettrick's observations. (Figure 48).

Williams (1956, unpubl.) was the first worker to mention minute hooks on the suckers and the specimens from all hosts in the present collection display this feature. The hooks are of a 'rose-thorn' shape and are approximately 0.005 mm. long. They are arranged in crescent-shaped rows 0.003 mm. apart with the maximum concentration at the anterior end of each sucker. They were present even on specimens which had lost their rostellar hooks so that their ommission from the descriptions of earlier workers must be ascribed to careless observation. It is remarkable that Mettrick did not mention this feature and unfortunate that the writer has not been able to check his material to determine

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Plate 27

Anomotaenia constricta (Molin, 1858)

Figure 47. Scolex. H.P. X 6.

Figure 48. Hook. Oil.

Figure 49. Mature segment. H.P. X 6.

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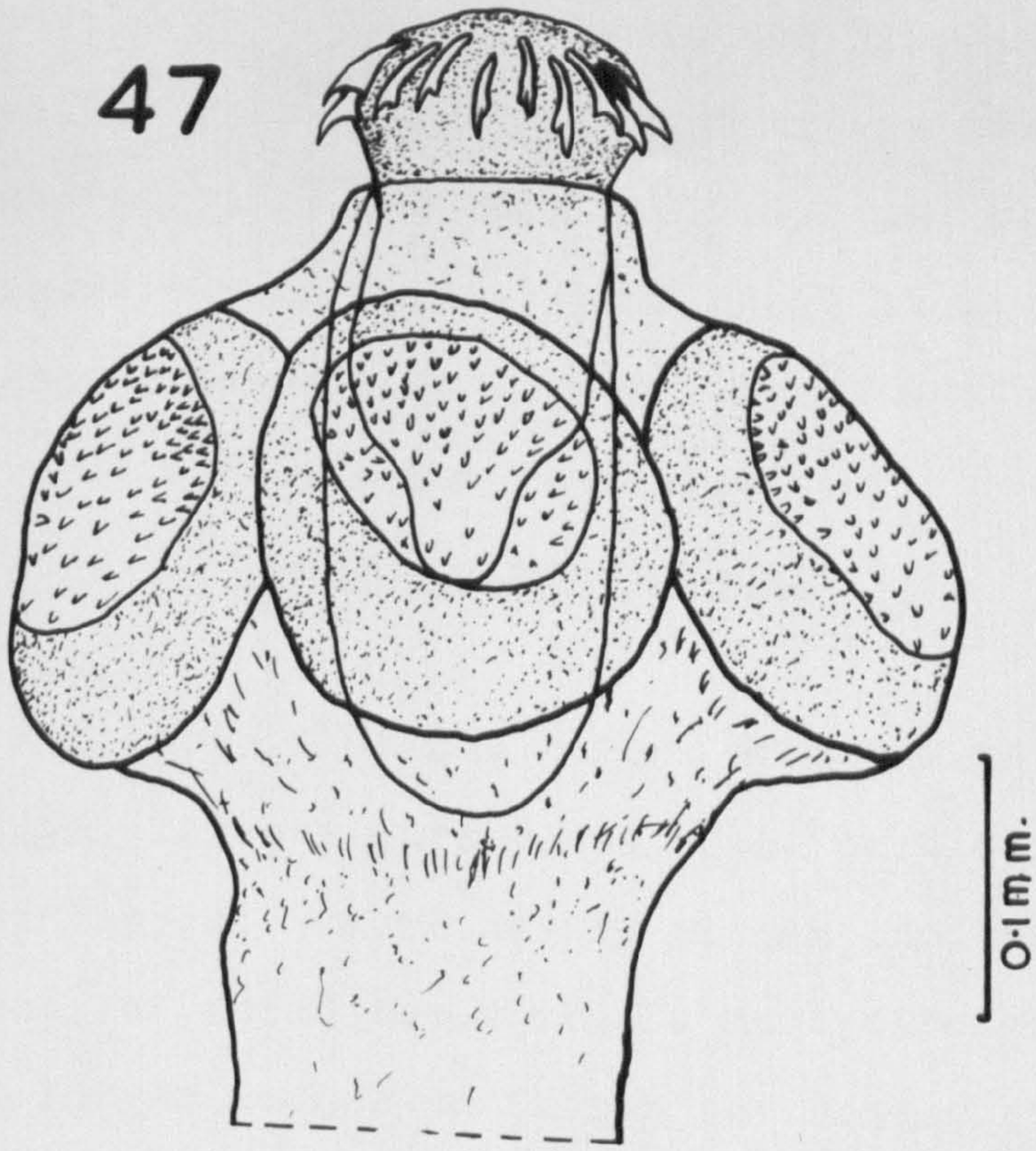

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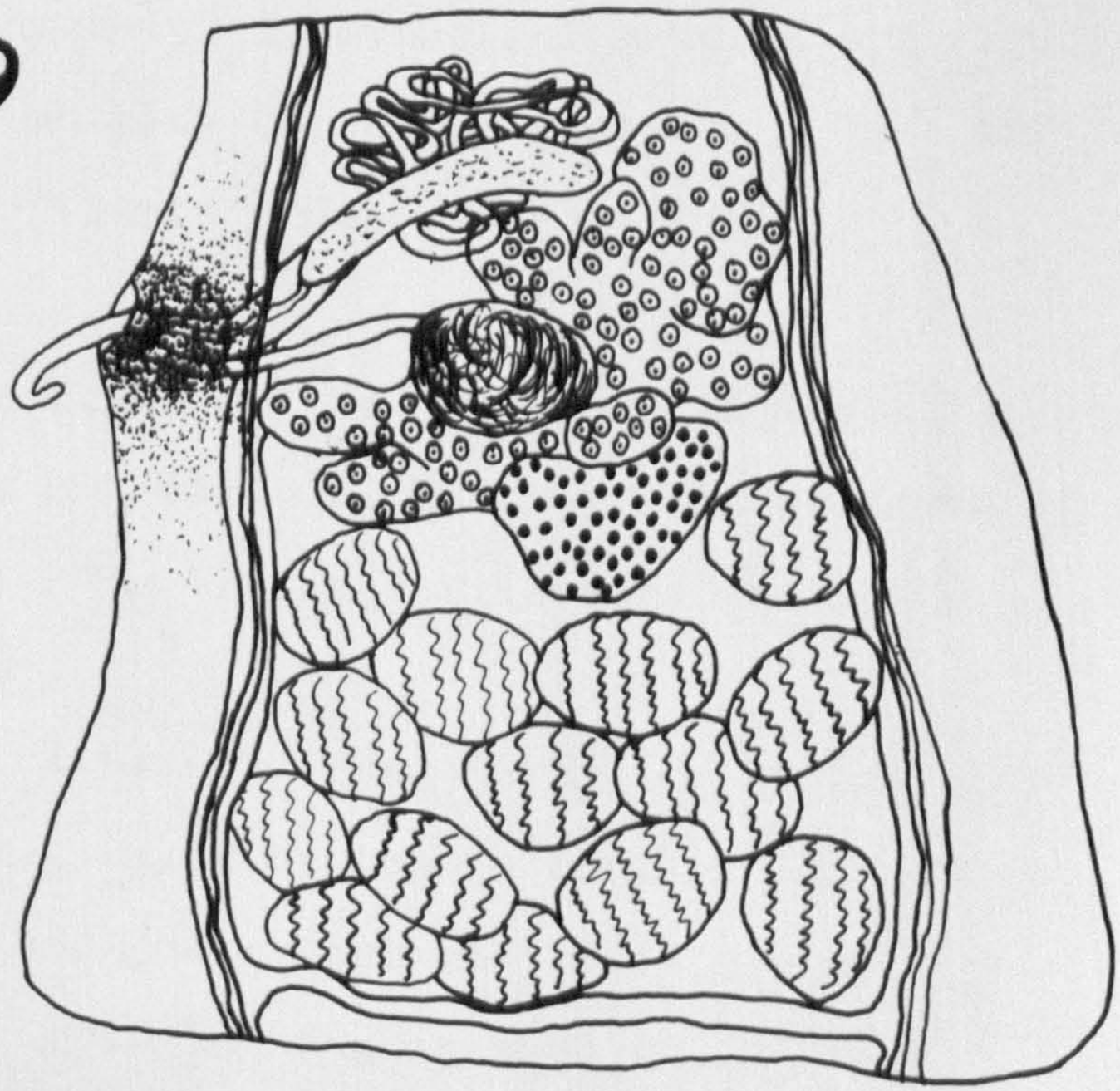

whether these hooks are exclusive to a regional strain(i.e.Welsh).

The genital primordia are patent by the 50th.segment and such a segment is 0.17 mm. long and 0.198 mm. wide. A mature segment (Figure 49) is typically of equal length and breadth while the gravid segment is rather longer, 0.63 mm., than broad, 0.588 mm. The segmentation is craspedote.

Internal Morphology.

a). Musculature.

There are three distinct layers of longitudinal muscles. The outermost layer is very narrow and found just below the cuticle and circular layers. More deeply within the cortex are layers two and three, of which the third is most strongly developed and possesses a larger number of fibres per bundle. (15 - 20). Between all the layers are narrow bands of transverse fibres. The second and third layers of longitudinal muscles are discontinuous at the lateral margins of the proglottid. This arrangement is typical of the Dilepid group.

b). Excretory system.

The dorsal vessels are 0.011 mm. in diameter while the ventral vessels, which alone do not atrophy in the gravid segments, are 0.034 mm. in diameter. The transverse vessels are 0.028 mm.across.

c). Reproductive System.

The genital atria alternate irregularly in the anterior quarter of each segment. Each atrium is shallow and not markedly muscular. The cirrus sac passes between the excretory vessels and opens antero-dorsally to the vagina with which it is parallel. The cirrus sac is rather small and lacking in

muscles and passes inwards in an anterior direction to join the coiled vas deferens. The largest sac was 0.212 mm. long by 0.022 mm. wide and contained at its proximal end a swollen seminal vesicle 0.035 mm. in length. There is no external seminal vesicle, the extensive coiling of the vas deferens is utilized for sperm storage. The testes, numbering 45 - 55, are oval in shape and measure approximately 0.082 mm. by 0.066 mm. In the immature segments they extend anteriorly around the female primordia and vas deferens, but in the mature segments they are restricted to the posterior half of the segment behind the female genitalia. The vas deferens is 0.01 mm. in diameter. The everted cirrus is 0.072 mm. long and 0.008 mm. wide and spined at the tip.

The vagina is 0.02 mm. in diameter and passes directly backwards or 0.155 mm. where it expands to form a receptaculum seminis. This is 0.1 mm. in diameter and on its ventral side a narrow duct joins the oviduct to form a fertilization canal, which then opens into the dorsal surface of Mehlis' gland. This latter organ is dorsal in relation to the rest of the female genitalia. It is in the mid-line and 0.065 mm. broad. It overlaps the vitelline gland which is kidney shaped, with Mehlis'gland contained in the anterior concave surface. It is slightly bilobed, 0.12 mm. by 0.045 mm. The ovary is a bilobed organ in the anterior third of the segment. The follicles of the aporal side are larger and more numerous than those of the poral side. It is 0.14 mm. across and proved very resistant to stain in the whole mounts.

From the anterior dorsal surface of Mehlis' gland, the uterus arises. It is a simple tube initially which rapidly becomes sac-like and overlaps the excretory ducts. Each egg is surrounded by a membrane 0.4 - 0.5 mm. in diameter, while the ovum itself is 0.024 - 0.028 mm. in diameter. The embryonic hooks are 0.015 mm. long.

Discussion.

The differences in the measurements of the internal anatomy and the hook number are not of sufficient significance to warrant the specimens being classified as anything other than Anomotaenia constricta (Molin, 1858). While Williams' (1956, unpubl.) observation on the acetabula spination and Mettrick's (1958) stressing of the range of variation in the rostellar hooks in different hosts is confirmed, the writer is unable to confirm Mettrick's statement regarding variation in the cirrus sac size in the various hosts. In all the mature segments, the cirrus sac is larger than Mettrick's highest figure, 0.14 mm.

The species is recorded in the Carrion Crow (Corvus corone corone L.), the Jackdaw (Corvus monedula L.) and the Redwing (Turdus musicus L.), in Wales for the first time.

10). Anomotaenia micracantha (Kr. 1869). Zschokke, 1903.

syn. Taenia micracantha Krabbe, 1869.

Taenia laricani (Rud. in Kr., 1869).

Krabbe described Taenia micracantha in the Kittiwake(Rissa tridactyla L.) from Iceland and Greenland, the Iceland (Larus glaucoides Mayer)and Ivory (Pagophila eburnea (Phipps). Gulls in Greenland, and the Common Gull (Larus canus L.) in Schleswig and Zeeland. It has since been recorded in Lariformes throughout the world and the most notable redescriptions are those of Schiller (1951) and Baer (1956).

The first British record is from Baylis (1939) in the Herring Gull (Larus argentatus Pont.). Williams (1962) recorded the species from Wales in the Herring Gull, the Great Black-backed Gull (Larus marinus L.) and the Common Gull, while Pemberton (1963) found the species in the Herring Gull, the Lesser Black-backed Gull (Larus fuscus L.) and the Black-headed Gull (Larus ridibundus L.). The writer's specimens were recovered from the Great Black-backed Gull (ten specimens from eight birds, Summer 1960, 61, 62), the Lesser Black-backed Gull (eleven specimens from four birds - Summer, 1960, 62, 63), the Herring Gull (eleven specimens from four birds - Summer, 1960,62, 63), the Herring Gull (numerous from eleven birds - all seasons 1960 - 1963), the Common Gull (five from two birds, January 1962) and the Black-headed Gull (three from two birds - December 1961 and January 1963).

Many specimens were stained and two were sectioned.

External Morphology

The white worms are found attached to the small intestine.

The strobila is 63 - 96 mm. long with a maximum breadth of 1. 5 mm. in the more contracted specimens. The scolex has a diameter of 0.428 mm. and has a distinctive appearance due to the muscularity of the suckers and the comparatively thin but greatly elongate rostellum (Fig. 50). The maximum length of this organ is 0.27 mm. when everted while the diameter rarely exceeds 0.036 mm., and even the terminal bulb is only 0.046 mm. in diameter. The rostellar sac is itself 0.27 mm. long which includes a marked terminal extension of the scolex as a "collar" surrounding the rostellum. There are 20 - 21 hooks, 0.03 - 0.037mm. long, with no significant difference between the hooks of the two rows (Fig. 51). The conspicuous oval suckers measure 0.148 - 0.165 mm. by 0.17 - 0.195 mm.

A typical early segment is wider than long, 0.021 mm. by 0.082 mm., and this condition also obtains in the more mature region of the strobila where a segment is 0.456 mm. by 0.765 mm. The development of the uterus seems to initiate a marked elongation of the segment and a typical gravid segment is 1.05 mm. long and 0.84 mm. across.

Internal Morphology

a). Musculature

There are two layers of longitudinal muscles which are continuous laterally round the medulla. In addition there is a distinctive layer of transverse muscles, which serve to limit the cortex, and scattered dorso-ventral muscles.

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Plate 28

Anomotaenia micracantha (Kr., 1869)

Figure 50. Scolex. H.P. X 6.

Figure 51. Hook. Oil.

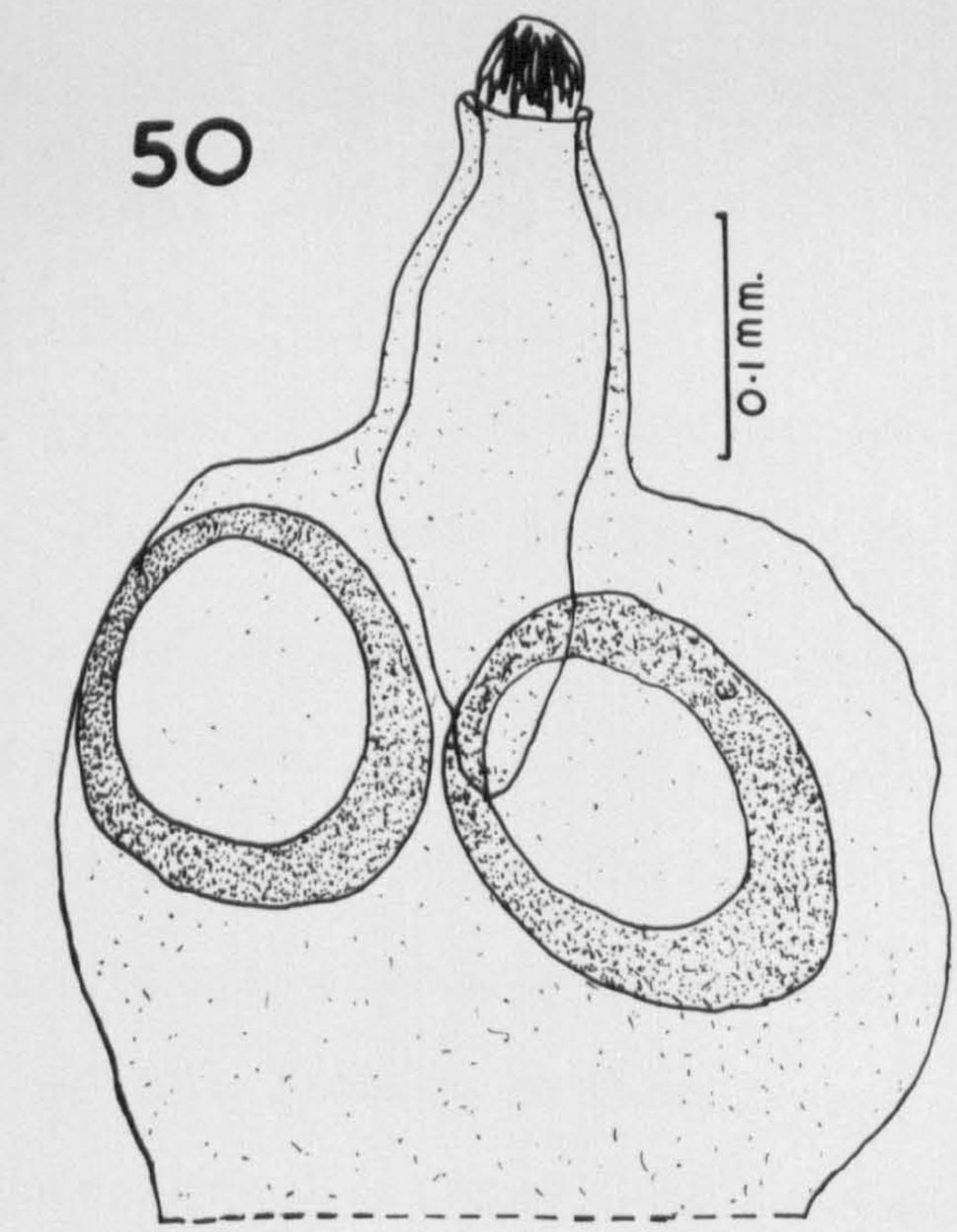
Figure 52. Mature segment. L.P. X 10.

Paricterotaenia embryo (Kr., 1869)

Figure 53. Scolex. H.P. X 10.

Figure 54. Hook. Oil.

Figure 55. Mature segment. H.P. X 6.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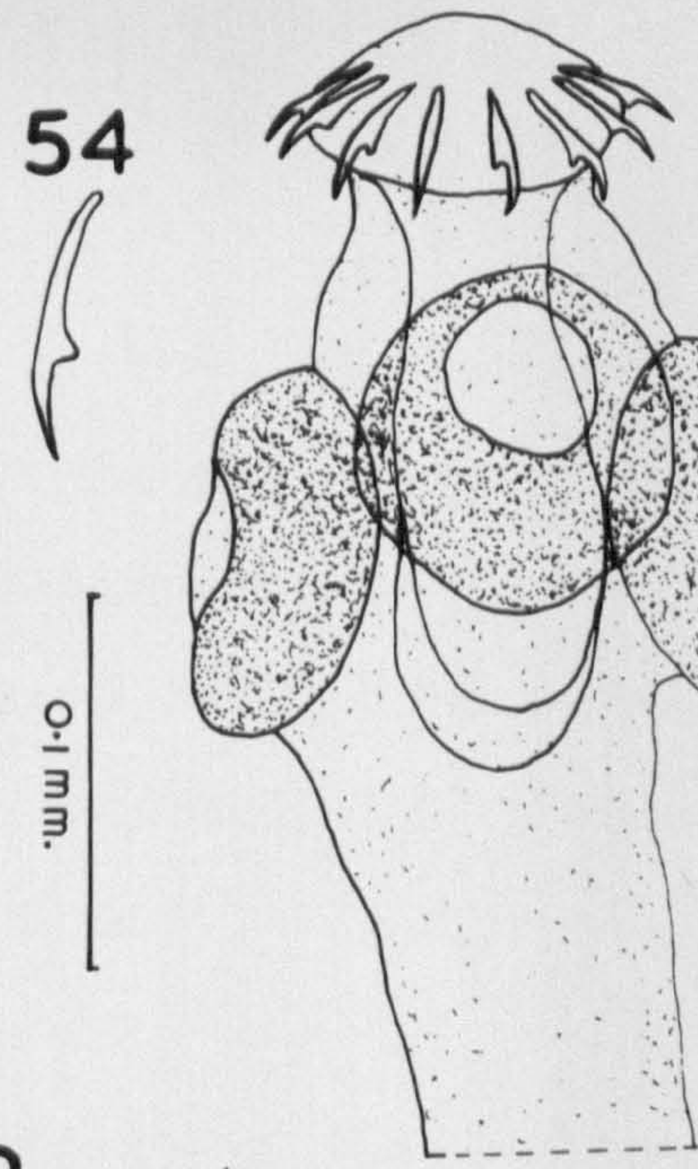
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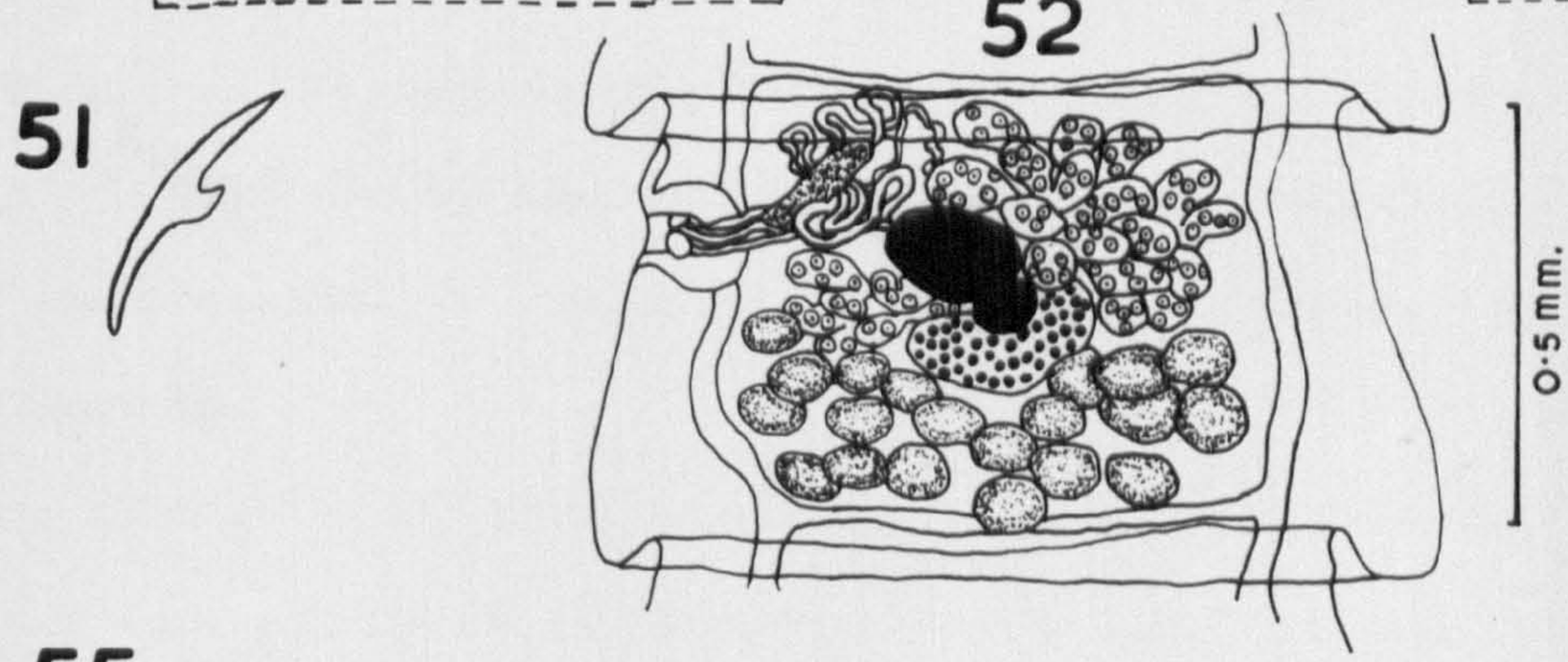
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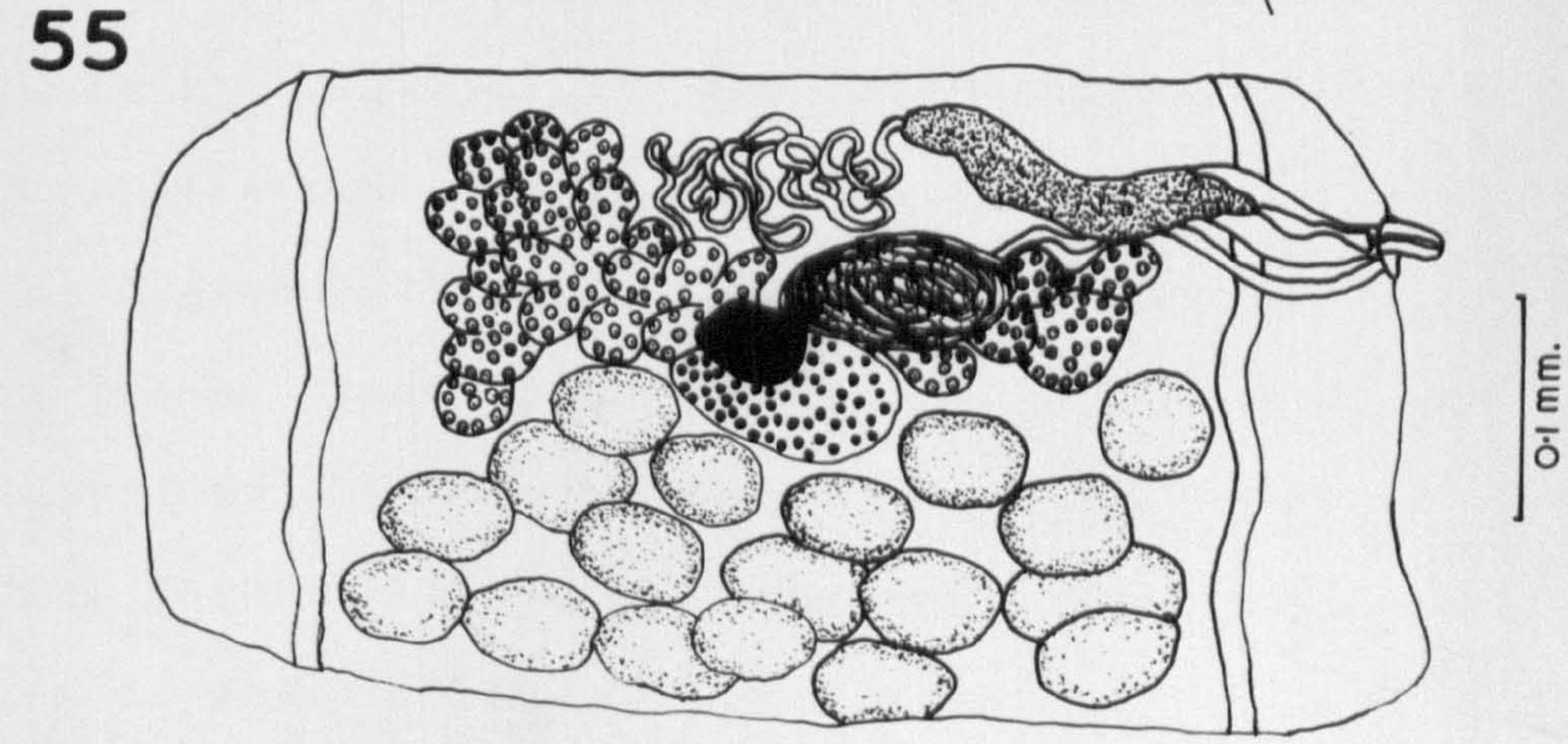
51
0·5 mm.


55
0·1 mm.

b). Excretory system

The dorsal vessels are 0.008 - 0.01 mm. wide and both the ventral vessels and the transverse vessels 0.036 mm.

c). Reproductive system

The primordia of the testes and the cirrus sac are evident by the 35th. segment, but those of the ovary and associated female organs are not seen until the 50th. All specimens examined indicate that the genital atrium is the last basic component to develop and it is always enveloped by the velum of the preceding segment in these strongly craspedote forms until the apparent maturity of the female system.

The atria are strongly muscular, irregularly alternate and in face view the slit-like apertures are bounded by thickened cuticular "lips," 0.065 mm. across. They are found in the anterior third of each segment. Each atrial cavity is 0.082 mm. deep by 0. 1 mm. across.

There are 19 - 20 round-to-oval testes, each 0.07 - 0.085 mm. in diameter and arranged in the posterior half of the segment behind the ovary (Fig. 52). They are contained within the excretory vessels and persist into the gravid segments. From each a fine sperm ductule emerges and anastomose to form a single duct which passes dorsally to the female genitalia to form a strongly developed, thick-walled and much coiled vas deferens in the anterior poral third of each segment. Its diameter is 0.015 - 0.018 mm. and accumulations of spermatozoa can be seen. The cirrus sac is thin-walled and contains at its proximal end an internal seminal vesicle, 0.05 - 0.1 mm. by 0.029 - 0.035 mm.

The cirrus sac is 0.205 mm. by 0.036 mm. overall, and emerges through the excretory ducts. The deep, cup-like nature of the genital atrium suggests that only self-fertilization occurs, especially since an everted cirrus was not observed. The relatively small invaginated cirrus could only extend to the adjacent vaginal opening.

The vagina has muscular walls and is 0.212 mm. in length. It opens ventrally and posteriorly to the cirrus sac and passes back between the excretory ducts to clear the mid-line, where it enlarges to form the spindle-shaped receptaculum seminis, 0.08 mm. by 0.066 mm.

In the mid-line proper is Mehlis' gland, 0.058 mm. in diameter. The ovary is bipartite and consists of thick lobes which are more numerous on the aporal side. It is in the anterior half. From it an oviduct fuses first with the vagina and then the vitelline duct before opening into Mehlis' gland. Ventral to both the ovary and Mehlis' gland is the lobed vitelline gland, 0.156 - 0.25 mm. by 0.084 - 0.14 mm.

The uterus emerges from Mehlis' gland and turns ventrally. Initially a simple tube, it develops lateral processes which fill out with gravid eggs until it fills the entire proglottid within the boundaries of the excretory canals. In contracted specimens, the initial out pushings are retained and the misleading impression of uterine "compartments" and even of a reticulate uterus is given. It is badly preserved specimens of this sort which are responsible for much of the confusion between Dilepid genera.

The egg capsule is 0.055 - 0.06 mm. in diameter and the ova,

TABLE 21: Anomotaenia microacantha (Krabbe, 1869)

Characters		Schiller, 1951	Baer, 1956	Williams 1956 (unpublished)	Author
Length of strobila		100.0 - 120.0	80.0 - 95.0	100.0	63.0 - 96.0
Maximum breadth		2.0	0.823	20.0	1.5
Scolex	Diameter	0.325	0.4	0.48 - 0.58	0.428
Rostellum	Length	0.288	0.229	0.2 - 0.37	0.27
	Breadth	0.072	-	-	0.036
	Bulb diameter	-	0.064	-	0.046
Hooks	Number	20 - 22(2)	20 - 21(2)	22(2)	20 - 21(2)
	Size	0.025 - 0.032	0.025 - 0.026	0.03 - 0.035	0.03 - 0.037
Suckers	Diameter	0.16	0.137 - 0.16 x 0.2 - 0.206	0.13 - 0.21	0.148- 0.165 x 0.17 - 0.195
Early segment	Length	-	-	-	0.021
	Breadth	-	-	-	0.082
Mature segment	Length	-	-	-	0.456
	Breadth	-	-	-	0.756
Gravid segment	Length	-	-	-	1.05
	Breadth	-	-	-	0.84
Excretory	Dorsal	-	-	-	0.008 - 0.01
	Ventral	-	-	-	0.036
Genital atrium			Irregularly alternated		
Testis	Number	16 - 20	13 - 18	28 - 30	19 - 26
	Size	0.072	-	0.07 - 0.09	0.07 - 0.085
Cirrus sac	Length	0.216	0.148- 0.157	0.21 - 0.26	0.205
	Diameter	0.024	0.032- 0.036	0.033- 0.05	0.038
Internal seminal vesicle		-	-	-	0.1 x 0.029
Vagina		-	-	-	0.212
Receptaculum seminis		0.09 x 0.075	-	-	0.08 x 0.066
Vitellaria		0.24 x 0.13	-	-	0.25 x 0.14
Envelope		-	0.06	0.04 - 0.045	0.055- 0.06
Ova		0.04 - 0.045	0.045x 0.039	0.023- 0.027	0.036- 0.044
Hooks		0.016	-	0.01 - 0.016	0.015- 0.016

0.036 - 0.044 mm., bear embryonic hooks 0.015 - 0.016 mm. long.

Discussion

Table 21 lists the recent measurements, of Schiller (1951), Baer (1956); and Williams (1956, unpubl.), together with those given above. In general, Williams' results, which are also from South Wales, are most consistent with the writer's material, in that the rostellar hooks and testes number are larger than those of other writers. The egg size is more consistent with Schiller's measurements.

Joyeux and Baer (1954) recognised two sub-species A.micracantha dominicans (Railliet et Henry, 1912) and Anomotaenia micracantha micracantha (Kr.1869). The writer's specimens are A.m.dominicans.

Williams recorded a thin-walled capsule around each egg, within the saciform uterus and placed the species doubtfully in Choanotaenia. In support of this action he mentions that Krabbe (1869) (Figure 20) also shows a shelled embryo within a thin uterine capsule. The writer's dissections of gravid segments has revealed no comparable structure and the thin 'uterine capsule' is almost certainly areas of uterine wall which are compressed around the eggs in strongly contracted specimens. Nothing remotely similar with the 'uterine envelope' derived from a reticulate uterus, as described in Choanotaenia larimarina Elce, 1962, was found.

The cestode has not been recorded from the Black-headed Gull (Larus ridibundus L.) from Wales.

Genus: Paricterotaenia Fuhrmann, 1932

syn. Choanotaenia Fuhrmann, 1907, nec Railliet, 1896

Icterotaenia Railliet et Henry, 1909

Parachoanotaenia Lühe, 1910

The genus Paricterotaenia was created by Fuhrmann to replace the genus Icterotaenia Railliet et Henry, 1909 and Parachoanotaenia Lühe, 1910. This was necessary because the geno-type galbulae had been shown to belong to Anomotaenia Cohn, 1900. The type species chosen was porosa Rudolphi (1810) but this has been shown to be a member of Choanotaenia by Lopez-Neyra (1951). The situation for the remaining members of the genus will be reviewed at the end of the section.

11). Paricterotaenia embryo (Kr. 1869) Fuhrmann, 1932

syn. Taenia embryo Krabbe 1869

Choanotaenia embryo (Kr. 1869), Clerc 1911

Icterotaenia embryo (Kr. 1869), Baer 1925

Krabbe described Taenia embryo in the Great Snipe (Capella media L.) and the Common Snipe (Gallinago gallinago L.). Clerc (1911) placed the species in Choanotaenia, and Baer (1925) in Icterotaenia. Further hosts are the Blacksmith Plover(Hoplopterus armatus (B.)) and the Jack Snipe (Lymnocryptes minimus (B)). From Britain the only previous recorded host is the Woodcock(Scolopax rusticola L.) at Mnydd Bach, Aberystwyth. (Davies, 1937 unpubl.).

The writer has found this species in the Common Snipe - three specimens in two birds, January, 1963. The two birds were shot on the Devonshire Drive, Ivy Towers, Tenby, Pembrokeshire.

External Morphology

There was a single scolex (Figure 53) and two further strobilae devoid of scolices. None of these specimens absorbed the stain satisfactorily.

The diameter of the scolex is 0.13 mm. It bears a well developed rostellum, 0.181 mm. long and 0.046 mm. across, the terminal bulb of which, 0.066 mm., bears a single row of 14 hooks, 0.032 mm. in length, (Figure 54). The suckers are not very muscular, 0.086 mm. by 0.07 mm., and tend to overlap the neck. The rostellar sac extends beyond the suckers into the neck. It is 0.115 mm. long and 0.042 mm. wide. The neck is 0.43 mm. long. An early segment is longer than broad, 0.21 mm. by 0.19 mm., but the mature segment (Figure 55) is broader than long, 0.324 mm. by 0.49 mm. A fully gravid segment was not available.

Internal Morphology

a). Musculature

Sectioning was not possible with such limited material in such poor condition.

b). Excretory system

The ventral vessel is narrow, 0.012 mm. wide and the dorsal vessel is only 0.004 mm. in diameter. It was not possible to distinguish the transverse vessel.

c). Reproductive system

The 15 to 25 testes occupy the posterior half of the proglottid and each is rounded, 0.045 - 0.055 mm. in diameter. They lead into a much coiled vas deferens, 0.009 mm. across, which itself opens into the long cirrus sac, 0.148 mm. by 0.016 mm. An

everted unarmed cirrus was found 0.058 by 0.011 mm. The genital atrium alternates very irregularly. The vagina is 0.12 mm. long and opens into a large round receptaculum seminis. The vitelline gland is 0.108 mm. across and on its antero-dorsal side is the small round Mehlis' gland, 0.03 mm. diameter. The ovary is bi-lobed and does not take the stain at all well. The uterus is saciform but mature onchospheres were not present.

Discussion

There has been no redescription of Paricterotaenia embryo (Kr. 1869) published in recent years and it is unfortunate that the present material was so poor as to make a good new account impossible. From the single row of hooks and the sac-like uterine development it is possible to place the species in Paricterotaenia, while the number of hooks and their length is indicative of embryo.

The Common Snipe (Gallinago gallinago L.) is a new host record for Britain.

12). Paricterotaenia mariae Mettrick, 1958

Mettrick found the cestode in the intestine of the Robin (Erithacus rubecula melophilos Hartert in Hertfordshire.

The author found two specimens in a robin in Pembrokeshire in January, 1961. Unlike Mettrick's specimens, they were fully gravid. Both were stained and mounted.

Description

Mettrick's original account is very clear and Table 22 shows the close affinity of the new material. At the close of his description Mettrick stated his intention of depositing the type in the Helminth Collection of the London School of Hygiene and Tropical Medicine. The type was not presented and the writer has been unable to examine this material.

Certain points may be noted. The relatively enormous rostellar sac, which extends well below the suckers into the neck region is seen in Mettrick's Figure 22, but the comparative uniqueness of this feature is not mentioned in the text. The neck is described as short and thick by Mettrick and in his Figure it is seen to be as wide as the scolex. The writer's more relaxed material shows this to be a feature of faulty preservation. In the writer's material the genital atria alternate regularly not irregularly. The spined cirrus extends up to 0.096 mm. The embryonic hooks are rather smaller, 0.009 mm.

Discussion

Mettrick was uncertain whether or not uterine capsules were formed in the fully gravid segments and provisionally placed the species in Paricterotaenia. No capsules are formed in this new

TABLE 22: Parioterotaenia mariae (Mettrick, 1958)

Characters		Mettrick, 1958	Auther
Length of strobila		65.0	13.0 - 23.0
Maximum breadth		0.83	0.215
Scolex	Diameter	0.2	0.25
Rostellum	Length	0.1 - 0.11	0.11
	Breadth	-	0.025
	Bulb diameter	0.06 - 0.07	0.084
Hooks	Number	10	10
	Size	0.048- 0.05	0.049 - 0.05
Rostellar sac		-	0.254 x 0.09
Suckers	diameter	0.1 - 0.11	0.112
Early segment	Length	-	0.098
	Breadth	-	0.19
Mature segment	Length	0.25	0.32
	Breadth	0.56	0.51
Gravid segment	Length	0.7	0.77
	Breadth	0.85	0.56
Excretory	Dorsal	0.006	0.006 - 0.008
	Ventral	0.016	0.02
Genital atrium		Irregularly	alternate
	Size	0.015	0.016
Testes	Number	12-14	12-14
	Size	0.025- 0.028	0.024 - 0.029
Cirrus sac	Length	0.18 - 0.22	0.17
	Diameter	0.024- 0.026	0.033
Cirrus	Length	-	0.096
	Breadth	0.016	0.014
Vagina	Diameter	0.012- 0.014	0.011 - 0.016
Receptaculum seminis		0.02 - 0.025	0.036
Ovary		0.16	0.15
Vitellaria		0.04 - 0.045	0.033 - 0.049
Envelope		0.03 - 0.038	0.033
Ova		0.024- 0.02	0.024 - 0.026
Hooks		0.012	0. 009

material so that this genus is correct.

Rysavy (1962) has recorded the species in Czechoslovakia, thus establishing the first record outside Britain.

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13). Paricterotaenia stellifera (Kr. 1869) Fuhrmann, 1932.

syn. Taenia stellifera Krabbe, 1869

Choanotaenia stellifera(Kr. 1869)Cohn, 1899.

Icterotaenia stellifera (Kr. 1869) Baer, 1925.

Krabbe described Taenia stellifera from the Woodcock(Scolopax rusticola L.), and the cestode has since been recorded from the Common snipe (Gallinago gallinago L.) and the Common Sandpiper (Tringa hypoleucos L.) throughout Europe.

Davies (1937 - unpubl.) provided the first British record of the worm in the Woodcock at Mnydd Bach, Aberystwyth, and Williams (1962) has found the species in the Common Snipe at Llanrhidian Marsh, Gower. The writer's material comes from the Woodcock (four worms from a single bird, December 1963), the Common Snipe (two worms in a single bird, January 1961) three worms in two hosts November 1962, three worms in a single host, January 1963) and the Jack Snipe (Lymnocryptes minimus (Brünnich)) - four worms in two birds, January 1963).

All specimens were stained and mounted or submitted to sectioning.

External Morphology.

The small white worm is found always in the rear part of the small intestine. The strobila is up to 10 mm. long and 0.5 mm. wide. The scolex is weak, 0.25 mm. in diameter and bears four oval suckers, 0.1 mm. by 0.06 - 0.07 mm., which overlap the neck, (Figure 56). The long rostellum, 0.1 - 0.1 mm. bears a terminal bulb 0.03 - 0.035 mm. wide on which are found a single row of hooks.

The ten hooks are of a uniform length, 0.062 - 0.068 mm.(Figure 57).

The neck is comparatively long, 0.346 mm. by 0.082 mm. The testes anlagens are evident by the 48th. segment, a typical immature segment measuring 0.05 - 0.1 mm. by 0.15 - 0.2 mm. The mature segments are also broader than long. 0.21 - 0.27 mm. by 0. 4 mm. and while this is true of the gravid segments generally, they often appear to be more equal as regards length and breadth. The proglottids are not markedly craspedote

Internal Morphology.

a). Musculature.

The cortical parenchyma contains two deep longitudinal muscle layers, between which are sparse transverse muscles layers. The outer bundles are larger and continuous except in the region of the genital ducts, 35 - 40 fibres per bundle, while the inner bundles have approximately 20 fibres.

b). Excretory.

The dorsal vessel is extremely small, a bare 0.003 mm. in diameter. The ventral vessel is 0.008 - 0. 016 mm. across and is connected at the posterior end of each segment by a transverse vessel 0.007 mm. in diameter.

c). Reproductive system.

11 to 14 testes are found in the posterior half of each segment. (Figure 58). They are 0.063 - 0.092 mm. in diameter and the sperm duct from each passes forwards to join the vas deferens which is 0.006 mm. in diameter and strongly coiled in the poral side of each proglottid. The cirrus sac is elongate, 0.111 - 0.116 mm. and runs diagonally forwards from the genital atrium to

a point near the mid-line at the anterior end of the segment. Its diameter is 0.016 - 0.022 mm. As the proglottid becomes mature so the genital atrium develops into a definite muscular protruberance. Within this cone, which is 0.063 mm. long and 0.048 mm. across, both the cirrus and vagina open. No protruding cirrus was observed and the cone seems to be a part of the male system, connected with and enclosing the evaginated cirrus, which within this cone is seen to be covered with minute spines. That the cone is eversible is demonstrated by the number of mature segments in which it is not in evidence, or only partially emitted.

The ovary is patent by the 73rd. segment. It is bilobed and inconspicuous, being obscured by the prominent vitellaria, the cirrus pouch and the extensive coiling of the vas deferens. The vitellaria is in the mid-line, roughly in the middle of the proglottid. It is oval at its optimum maturity, 0.12 mm. by 0.066 mm. and Mehlis' gland is seen as a small round organ on its dorsal side. The uterus is sacciform and completely fills the proglottid. The ova are 0.023 - 0.029 mm. diameter with an egg shell 0.04 - 0.06 mm. diameter; the embryonic hooks are 0.01 - 0.011 mm. long.

Discussion.

The most recent redescription, and the only previous one from British material, has been provided by Williams (1956 - unpubl.). He assigned the species to Choanotaenia, and described the subsequent development of the sac-like uterus as including indentation, corrugation and sub-division into separate loculi, each with one onchosphere. This is justification enough to place the material into the genus Choanotaenia as it is defined

at present. However, an extremely careful examination of the most gravid segments from the present collection, has not revealed the features recorded by Williams. This material must therefore be assigned to Paricterotaenia. The description above differs from the account of López-Neyra (1944) in the possession of a greater number of testes and the larger rostellar hooks. The Jack Snipe (Lymnocryptes minimus (Brünnich)) is a new host.

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Plate 29

Paricterotaenia stellifera (Kr., 1869)

Figure 56. Scolex. H.P. X 6.

Figure 57. Hook. Oil.

Figure 58. Mature segment. H.P. X 6.

Trichocephaloides megalocephala (Kr., 1869)

Figure 59. Mature segment. H.P. X 6.

Figure 60. Cirrus sac. H.P. X 10.

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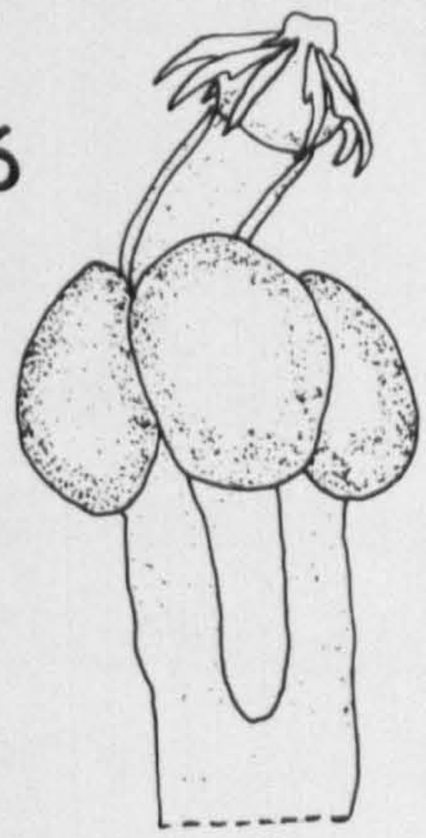

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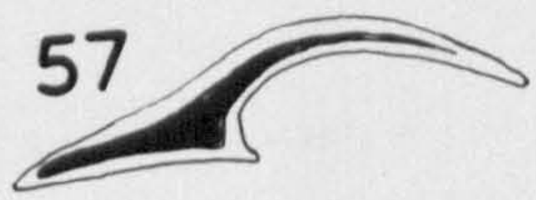

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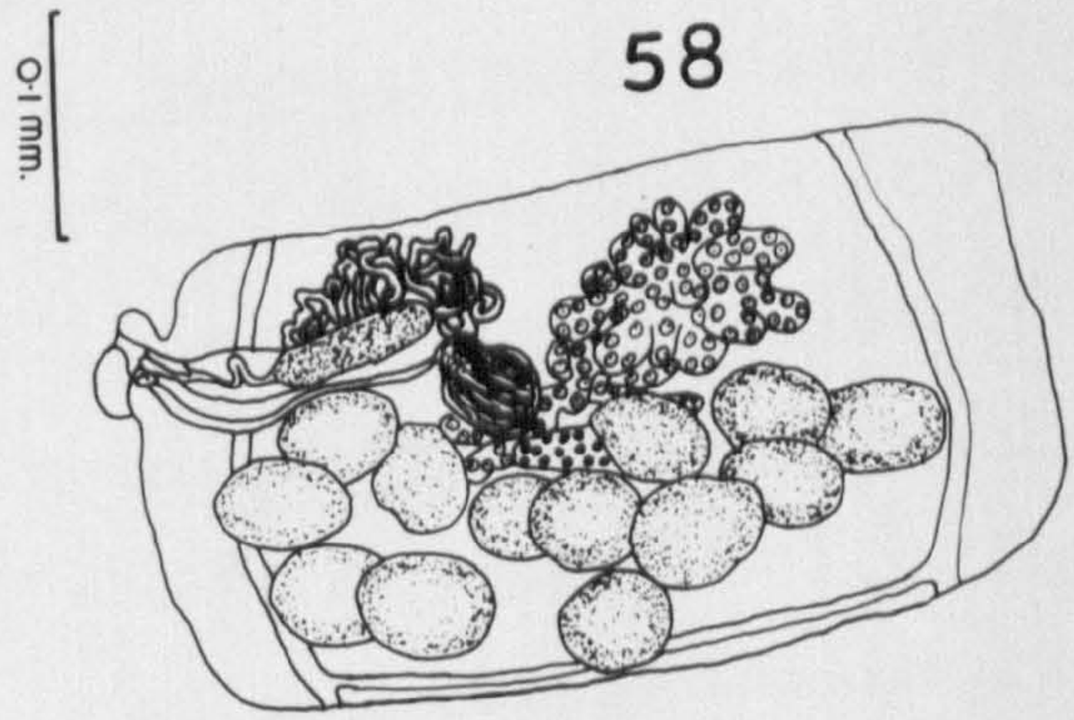

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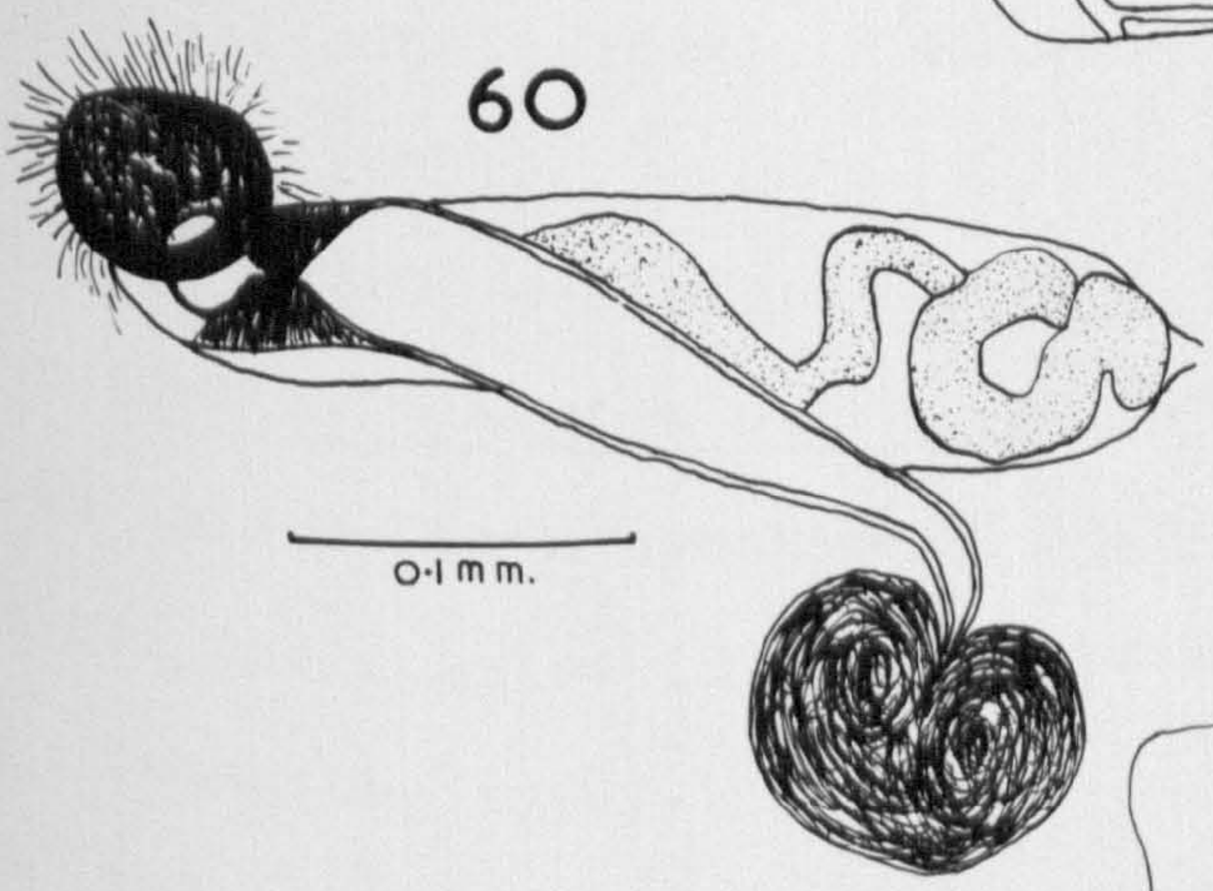

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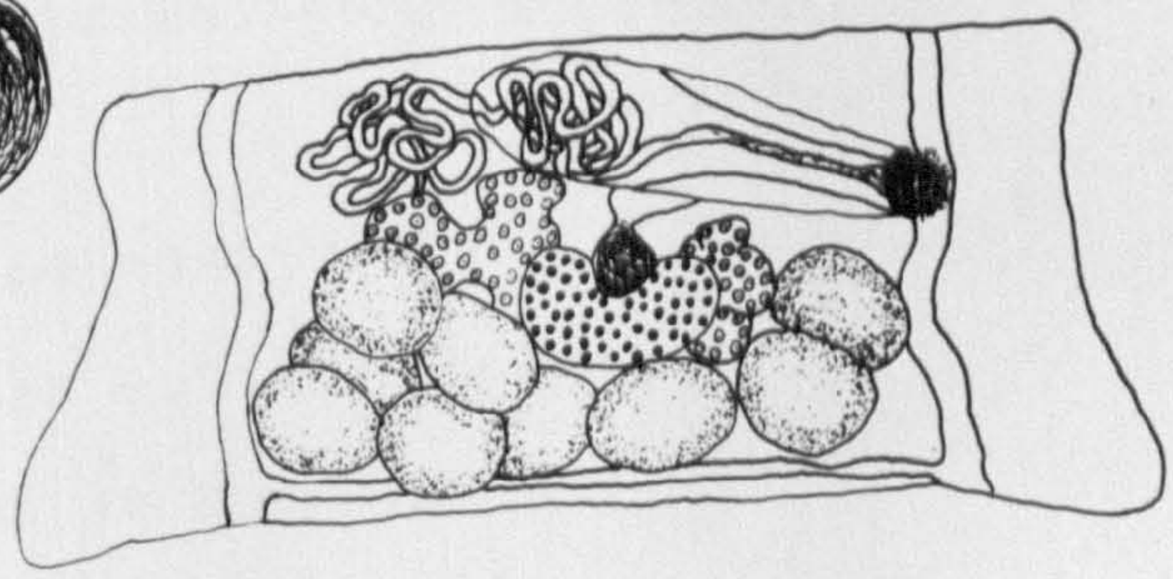

Genus: Trichocephaloides Sinitzin, 1896.

This genus was created by Sinitzin for his species inermis in 1896, which was obtained from the Dunlin (Calidris alpina (L)) The genus is distinguished from all other Dilepids by the position of the genital pore, which is found dorso-laterally on the right-hand side.

14). Trichocephaloides megalocephala (Krabbe, 1869) Clerc, 1902.

syn. Taenia megalocephala Krabbe, 1869.

Trichocephaloides inermis Sinitzin, 1896.

Trichocephaloides hamasigi (Yamaguti, 1940) Yamaguti 1958

Krabbe described his material from the Dunlin at Pomerania, North Germany. Fuhrmann (1901) established Trichocephaloides inermis Sinitzin 1896 as a synonym of Taenia megalocephala Krabbe, 1869, but it was Clerc (1902) who first compunded Trichocephaloides megalocephala (Krabbe, 1869). He redescribed the species the following year, (1903).

Yamaguti (1940) described Dilepis hamasagi from the Red-backed Sandpiper (Calidris alpina sakhalina Vieilliot) and in 1956, Baer considered this to be a synonym of megalocephala. Yamaguti (1958) has retained the species in a new combination Trichocephaloides hamasigi (Yamaguti, 1940).

Williams (1962) has recorded the species once from a single Dunlin at Dovey Estuary. The writer obtained a single strobila without a scolex from a Dunlin, shot at Monkstone Point, Saundersfoot in March, 1962. The worm was a broken white in colour prior to staining and mounting.

External Morphology.

There is no scolex and it is impossible to state relatively when the genitalia become patent. A typically immature segment is 0.156 mm. by 0.198 mm. This pattern is continued in both the mature segments, 0.212 mm. by 0.374 mm, and the gravid segments, 0.332 mm. by 0.63 mm. All are markedly craspedote.

Internal Morphology.

a). Musculature.

Sectioning of the single strobila was not feasible.

b). Excretory ducts:

The dorsal vessels are 0.006 mm. in diameter and are external to the ventral vessels which are 0.015 mm. in diameter, (Figure 59). Only the ventral vessels continue to function in the gravid segments. The transverse vessels are 0.008 mm. in diameter.

c). Reproductive system.

There are 8 to 11 testes found in the hindmost part of the segment behind the ovary. They extend laterally to reach, but do not extend beyond, the excretory vessels. Each is rounded, 0.056 - 0.075 mm. in diameter. The sperm ducts unite and lead into the strongly developed much coiled vas deferens. This is found anteriorly on the aporal side of the proglottid and is 0.01 mm. in diameter. There is no external seminal vesicle, the vas deferens leading directly into the elongated cirrus sac, the proximal end of which is swollen (0.018 mm. across) as a ductus ejaculatorus. The cirrus sac itself is 0.254 mm. long, that is, it extends well beyond the midline and its course runs obliquely backwards from a ventral anterior origin to a genital atrium that

opens dorso-laterally approximately one-third of a segment behind. The sac is 0.05 mm. in diameter and contains a stout, strongly spined cirrus which can be everted for up to 0.06 mm. The spines are 0.012 mm. long. The genital atrium is 0.055 mm. from the lateral margin. Each is unilateral and fairly muscular, with an orifice 0.045 mm. across. The cirrus opens form the ventral side and dorsally the vaginal opening is found. This is very narrow sphincter which proceeds inwards anteriorly, following the course of the cirrus sac. (Figure 60). It dilates into a large muscular bulb, 0.184 mm. by 0.045 mm. which veers posteriorly on reaching the midline and terminates in a constricted duct. This duct dilates shortly afterwards to form the receptaculum seminis, which is dorsal to the ovary, 0.035 - 0.085 mm. when full of spermatozoa.

The ovary is a fairly large bipartite organ which is not deeply lobed. It is 0.1 mm. across and may extend to the ventral excretory vessels. The subglobular vitellaria is 0.063 mm. in diameter, while on the anterior dorsal side is the small round Mehlis' gland, 0.027 mm. in diameter. From the poral side of Mehlis' gland a small sac emerges which increases in size as the proglottid ripens. This is the uterus which rapidly fills the anterior half of the segment within the vessels and then expands to occupy all the medulla of the gravid segment other than the most posterior region in which testes remain. A fully gravid segment in which the embryonic hooklets could be studied was not available.

TABLE 23: Trichocephaloides megalocephala (Krabbe, 1869)

Characters		Lühe, 1910	Yamaguti, 1940	Author
Length of Strobila		25.0 - 50.0	40.0	-
Maximum breadth		0.6 - 1.0	0.1	-
Scolex	Diameter	0.240 - 0.33	0.35 - 0.65	-
Rostellum	Length	-	0.24 - 0.4	-
	Breadth	-	0.1 - 0.17	-
Hooks	Number	20	20	-
	Size	(a) 0.073 - 0.085 (b) 0.08 - 0.082	0.084	-
Rostellar sac		-	0.3 - 0.58	-
Suckers -	Diameter	0.12	0.17 - 0.28	-
Early Segment	Length	-	-	0.156
	Breadth	-	-	0.198
Mature Segment	Length	-	-	0.212
	Breadth	-	-	0.374
Gravid segment	Length	-	-	0.332
	B readth	0.46	-	0.63
Excretory	Dorsal	-	-	0.006
	Ventral	-	-	0.015
Genital atrium		-	-	unilateral
	Size	-	-	0.045
Testis	Number	18	7-8	8-11
	Size	0.06 - 0.08	small, round	0.05 - 0.075
Cirrus Sac	Length	0.18	0.16	0.254
	Diameter	-	0.07	0.05
Cirrus	Length	-	0.09	0.06
	Breadth	-	0.042	0.03
Vagina		-	0.045 - 0.054	0.184 x 0.045
Receptaculum seminis		-	-	0.035 - 0.085
Ovary		0.11 x 0.039	small	0.1
Vitellaria		0.03 - 0.08	-	0.063

Discussion.

The presence of the unilateral genital atrium on the dorso-lateral surface indicates that the species described is Trichocephaloides megalocephala (Krabbe, 1869) Clerc, 1902. While the only previous British record is also from Wales, Mr. R. Knowles of the Natural History Museum has loaned the writer a slide of material from the Dunlin shot in Essex, There has been no published description from British material and no new description since that of Clerc (1903) which was reproduced by Lühe (1910)

The species which Yamaguti (1940) has since placed in the genus as T. hamasigi (Yamaguti, 1940) Yamaguti 1958 and which Baer (1956) considers to be a synonym, is also included in Table 23, together with Lühe's derivative measurements. It will be seen that hamasigi differs principally in the smaller number of testes present (7-8). Baer notes that the co-types in his own collection have only 8 - 10 testes. The larger number of testes in the writer's material and the even larger number recorded by Clerc (1903) and Williams (1956 - unpubl.) indicate that this feature is very variable and Yamaguti's species must fall as a synonym.

Genus: Gryporhynchus Nordmann, 1832.

syn. Acanthocirrus Fuhrmann, 1907.

The genus was created by Nordmann in 1832, for a new species pusillus from Herons. The synonym Acanthocirrus derives from Fuhrmann's species Macrorsotratus (1907) which Ransom (1909) concluded should be placed with Gryporhynchus.

15). Gryporhynchus retirostris (Krabbe 1869) Belopolskaya, 1953.

syn. Taenia retirostris Krabbe, 1869.

Dilepis retirostris (Kr. 1869) Zschokke, 1903.

Acanthocirrus retirostris (Kr. 1869) Baer, 1956,

Krabbe (1869) described Taenia retirostris from the Dunlin (Calidris alpina L.). Zschokke (1903) placed the species under Dilepis Weinland 1858. In 1907, Fuhrmann described Acanthocirrus macrorostratus from the Meadow Pipit (Anthus pratensis (L)) in Egypt. Baer (1956) states categorically that Fuhrmann only supposed the material to have been found in this host but provides no proof for this statement, and also maintains that Ransom (1909) was wrong to re-classify this species as Gryporhynchus macrorostratus and suppress Acanthocirrus. He states that while Fuhrmann's macrorostratus and Krabbe's retirostris are identical, the species differs from the genotype of Gryporhynchus in having spines which are not independent of the cirrus pouch and rostellar hooks not possessing the characteristic shape. He therefore saw fit to revive the genus Acanthocirrus with retirostris as type. Yamaguti (1959) has followed Belopolskaya (1953) and retained both retirostris Krabbe 1869 and macrorostratus Fuhrmann 1907 under Gryporhynchus.

The only previous British record of the species is by Williams (1962) in the Turnstone (Arenaria interpres L.). The writer's material was also found in the Turnstone where it was always associated with Choanotaenia clavigera (Kr. 1869). There were seven specimens in three birds, shot July, 1962, November 1962 and June 1963). One cestode was sectioned, the remainder stained and mounted.

External Morphology.

The white worms are found in the rear part of the small intestine. The length of a relaxed specimen varies between 30 - 40 mm. and the maximum breadth was 0.714 mm. The scolex (Figure 61) is well developed, being up to 0.284 mm. in diameter. The rostellum is exceptionally large, the maximum in the present collection is 0.346 mm. long and 0.088 mm. wide. It extends 0.065 mm. beyond the suckers into the neck region. The rostellar sac extends even further into the neck - it is 0.24 mm. long and 0.075 mm. wide. The terminal bulb of the rostellum is 0.142 mm. in diameter and bears 20 hooks in a double row. The first row is slightly smaller, 0.07 mm. and the second row 0.074 mm. This feature is constant (Figure 62). The suckers are smaller and not very muscular, 0.13 - 0156 mm. across. Figure 61 shows clearly that the principle means of attachment to the host is the strong rostellum.

A neck follows which can be up to 0.4 mm. long by 0.198 mm. in diameter. The first segment in which the genital primordia are evident is slightly broader than long, 0.156 mm. by 0.228 mm. An early mature segment also follows this pattern, 0.24 mm. by

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Plate 30

Gryporhynchus retirostris (Kr., 1869)

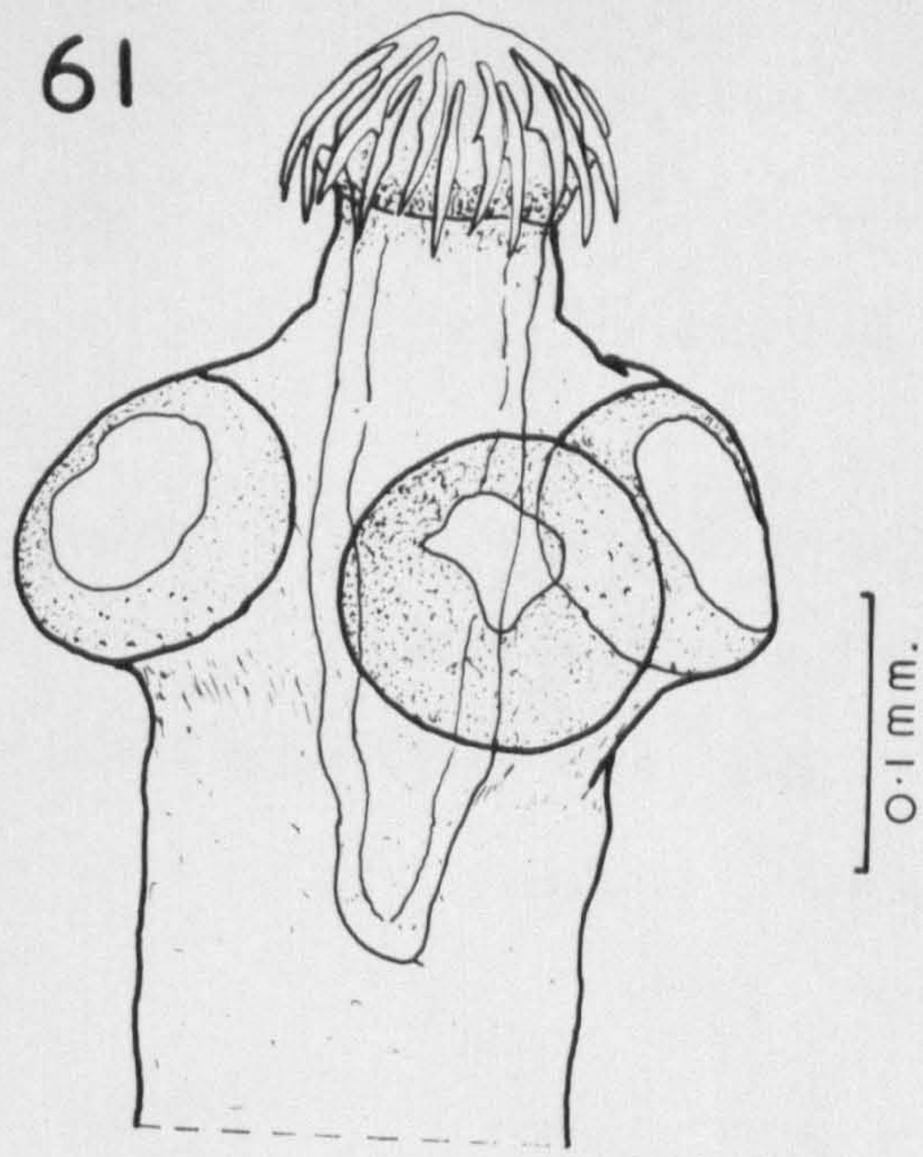
Figure 61. Scolex. H.P. X 6.

Figure 62. Hook. Oil

Figure 63. Mature segment. H.P. X 6.

Figure 64. Cirrus sac. Oil.

61



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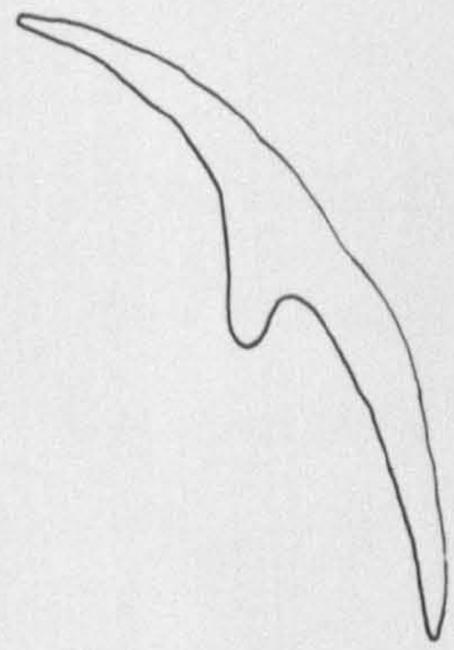

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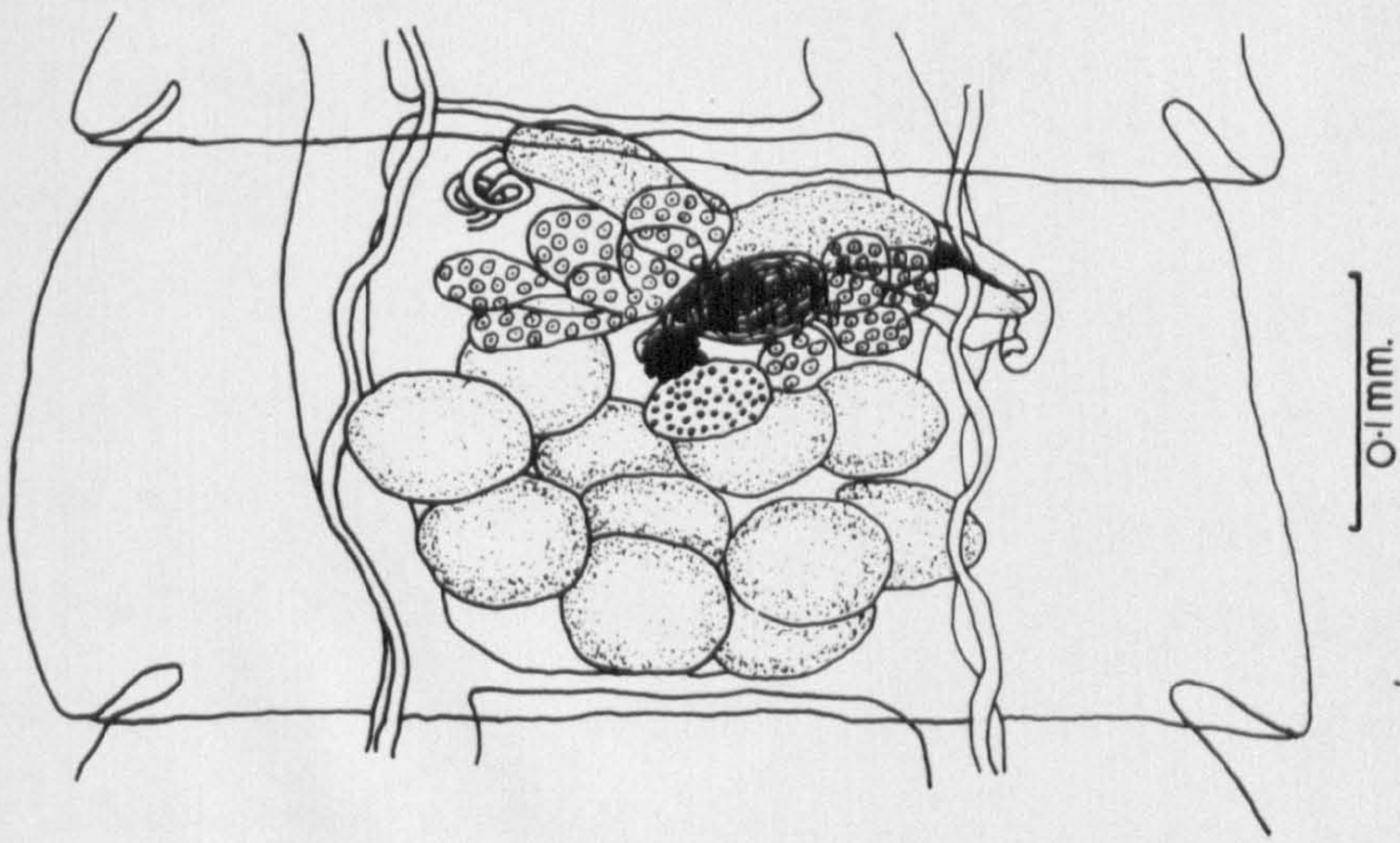

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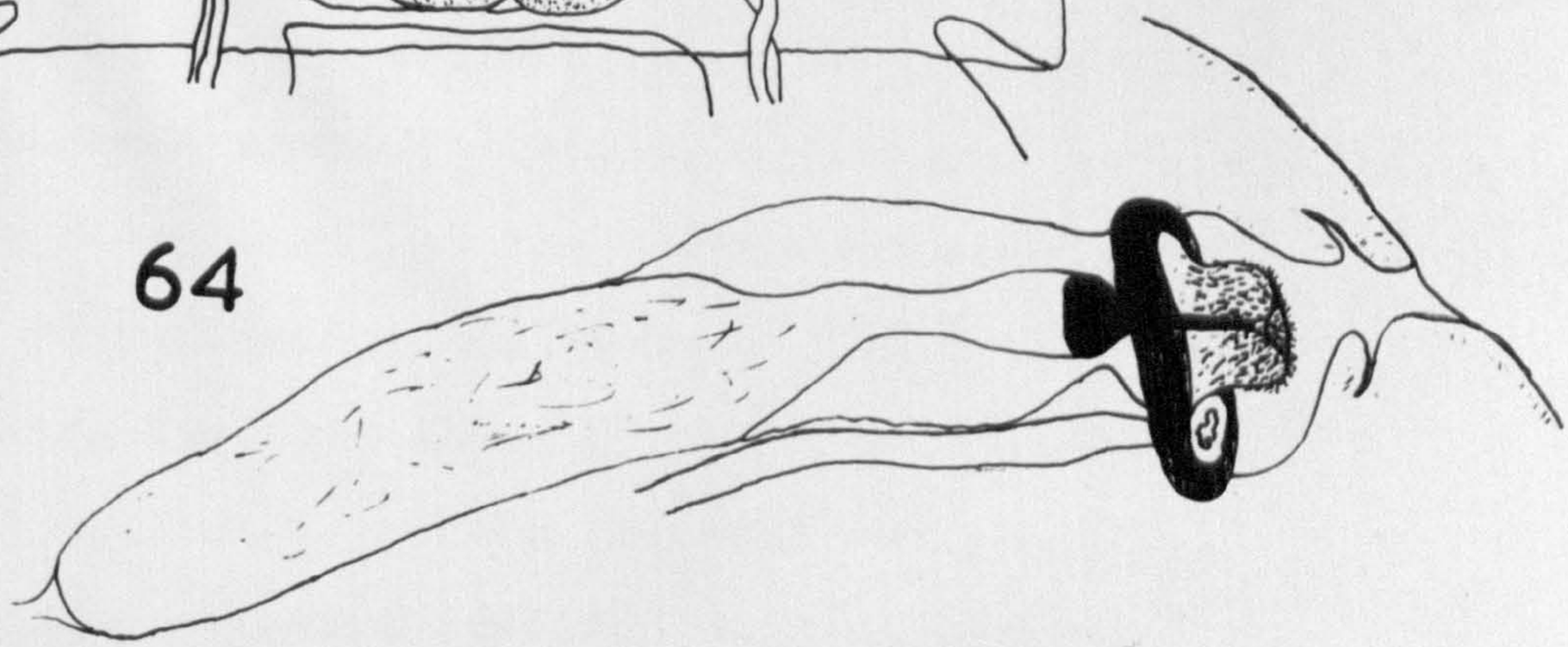


0.45 mm. The gravid segment may be broader than long, 0.47 mm. by 0.588 mm., or in some isolated proglottids which had been shed and which were recovered further down the intestine there has been a rounding off which has resulted in equal dimensions.

Internal Morphology.

a). Musculature.

The two layers of longitudinal muscles in the cortex are separated by layers of transverse muscles. The outer longitudinal layer is continuous except in the region of the genital ducts and has at least 30 fibres per bundle. The inner layer has fewer, usually 15 to 30.

b). Excretory System.

The dorsal vessel is 0.006 mm. in diameter, the ventral 0.021 mm. and the transverse, 0.008 mm.

c). Reproductive system.

The 10 to 12 testes are posterior to the female genitalia and are 0.063 mm. across (Figure 63). The vas deferens is considerably less coiled than in other Dilepids and it is found on the aporal side in front of the ovarian lobes. The cirrus sac is long, 0.165 - 0.215 mm., with a width of 0.03 mm. Proximally it contains an internal seminal vesicle. It opens into a unilateral genital atrium which opens on the right-hand side of the proglottid. The cirrus is very muscular and bears at its base a pair of large spines, the characteristic shape of which may be seen in Figure 64. They are 0.045 mm. long. There are some smaller additional spines but the number and relative position cannot be determined in the present material in which none of the cirri are everted.

The vagina follows the course of the cirrus and then veers posteriorly to the pear-shaped seminal receptacle, 0.086 mm. across. It opens dorso-posteriorly into the atrium and it is 0.006 mm. wide. The small round vitelline gland occupies the centre of the segment, 0.065 mm. by 0.068 mm. On its antero-dorsal side is Mehlis' gland, 0.035 mm. across. The ovary is 0.165 mm. across and has 7 aporal lobes and 4 poral. Each has a diameter of 0.03 mm. The uterus is saciform and contains onchospheres, 0.046 mm. in diameter. Each ovum is 0.036 - 0.038 mm. wide and the embryonic hooks are 0.009 - 0.011 mm. long.

Discussion.

The only previous description from British material has been provided by Williams (1956 - unpubl.) who did not find the cirral spines and described the formation of uterine capsules. It has not been possible to examine Williams' material but since that from the present collection is closely aligned to Baer's redescription, the presence of uterine capsules suggests that Williams may be guilty of incorrect identification. He has not published his work.

Sub-family Dipylidiinae Stiles, 1896.

Genus: Choanotaenia Railliet, 1896.

syn. Monopylidium Fuhrmann, 1899.

Prochoanotaenia Meggitt, 1924

Monopylidium sub.gen. Macracanthus Moghe, 1925.

Monopylidium sub.gen. Megalocanthus Moghe, 1925.

Multitesticulata Meggitt, 1929.

Viscoia Mola, 1929.

Choanofuhrmannia López-Neyra, 1935.

Dichoanotaenia López-Neyra, 1944.

Dictymetra Clark, 1952.

Monopylidium emend. Sandeman, 1959.

The genus Choanotaenia was named by Railliet in 1896 with T. infundibuliformis Goeze, 1780 as type. The correct name for the type species has since been acknowledged as Choanotaenia infundibulum (Bloch, 1779) Cohn, 1899. A great deal of confusion surrounds the genus since Bloch's original description of the type included a strongly lobed saciform uterus, while Clerc (1903) and Fuhrmann (1899) both included the possession of single eggs each with an individual parenchymatous capsule, in their definition of the genus. Railliet and Henry (1909) transfered to an additional genus, Icterotaenia, those forms which have a persistent uterus, with galbulae Gmelin, 1790, as type. Fuhrmann (1932) reunited Monopylidium with Choanotaenia because of the identical morphology and the difficulty in determining the exact nature of the rostellar hooks. The genotypes of Multitesticulata Meggitt, 1927 and Viscoia Mola, 1929 were shown by Baer (1932)

to be synonyms of existing Choanotaenia species. In both 1935 and 1944, López-Neyra split off individual species, viz. unicoronata and clavigera and created two new genera, Choanofuhrmannia and Dichoanotaenia which he has subsequently withdrawn (1952). Sandeman (1959) attempted a revision of the Dilepididae of Charadriiformes which will be discussed more fully below. His work is not very satisfactory and has not been followed by other taxonomists. For the purposes of this survey, Fuhrmann's definition (1932) of a single or double row of hooks and a sac-like or reticulate uterus which breaks down into egg capsules has been retained.

16). Choanotaenia clavigera (Kr. 1869) Clerc, 1903.

syn. T. clavigera Kr. 1869.

Anomotaenia clavigera (Kr. 1869) Cohn, 1901.

Taenia clavigera was described from the Turnstone (Arenaria interpres L.) in Greenland and from the Dunlin(Calidris alpina(L)). in the Faroes Isles. Cohn (1901) redescribed the species from the Knot (Calidris canutus (L.)) from an un-named locality and Clerc (1903) recorded the species from the Little Stint (Calidris minuta (L.)) in the Urals. López-Neyra (1944) redescribed the species from the Woodcock (Scolopax rusticola L.) and transferred it to a new genus Dichoanotaenia which he retracted in a later revision (1952). Sandeman (1959) placed the species in Anomotaenia as the double row of rostellar hooks precluded it from Paricterotaenia and the absence of parenchymatous capsules from Monopylidium.

The only previous British record is from the Turnstone

(Williams, 1962). The writer's material is also from the Turnstone where it is found at all times of the year save the hardest Winter months. (None in January - February, 1963). The cestodes occupy the small intestine and are frequently found in association with Gryporhynchus retirostris (Kr. 1869) Belopolskaya, 1953.

External Morphology.

The worms are of medium size, 85 mm. by 0.98 mm. As always the degree of infestation is the major influence on length; gravid worms of 13.5 mm. have been found as well as unripe worms 115 mm. long. The scolex is smaller in all specimens than in the record of earlier workers, the diameter varying between 0.132 - 0.212 mm. in gravid worms (Figure 65). The suckers are large, 0.162 - 0.178 mm. by 0.312 - 0.346 mm. with the orifice directed anteriorly rather than laterally.

The rostellum is comparatively long and thin, 0.132 - 0.232 mm. by 0.024 - 0.027 mm. and the terminal bulb is 0.042 - 0.048 mm. in diameter. There are either 20 or 22 hooks arranged in a double row, the first of which is smaller, 0.02 - 0.022 mm., while the second row has larger hooks, 0.026 - 0.027 mm. (Figure 66). The scolex is extended anteriorly as a protective collar around the rostellum.

Behind the scolex is an unusually elongate neck region, 0.346 mm. on average. The diameter is approximately 0.165 mm. This area merges into a region of indistinct segmentation, which is also exceptionally extensive. The genital primordia are usually patent by the 40th - 60th segments in cestodes of these

Plate 31

Choanotaenia clavigera (Kr., 1869)

Figure 65. Scolex. H.P. X 6.

Figure 66. Hook. Oil.

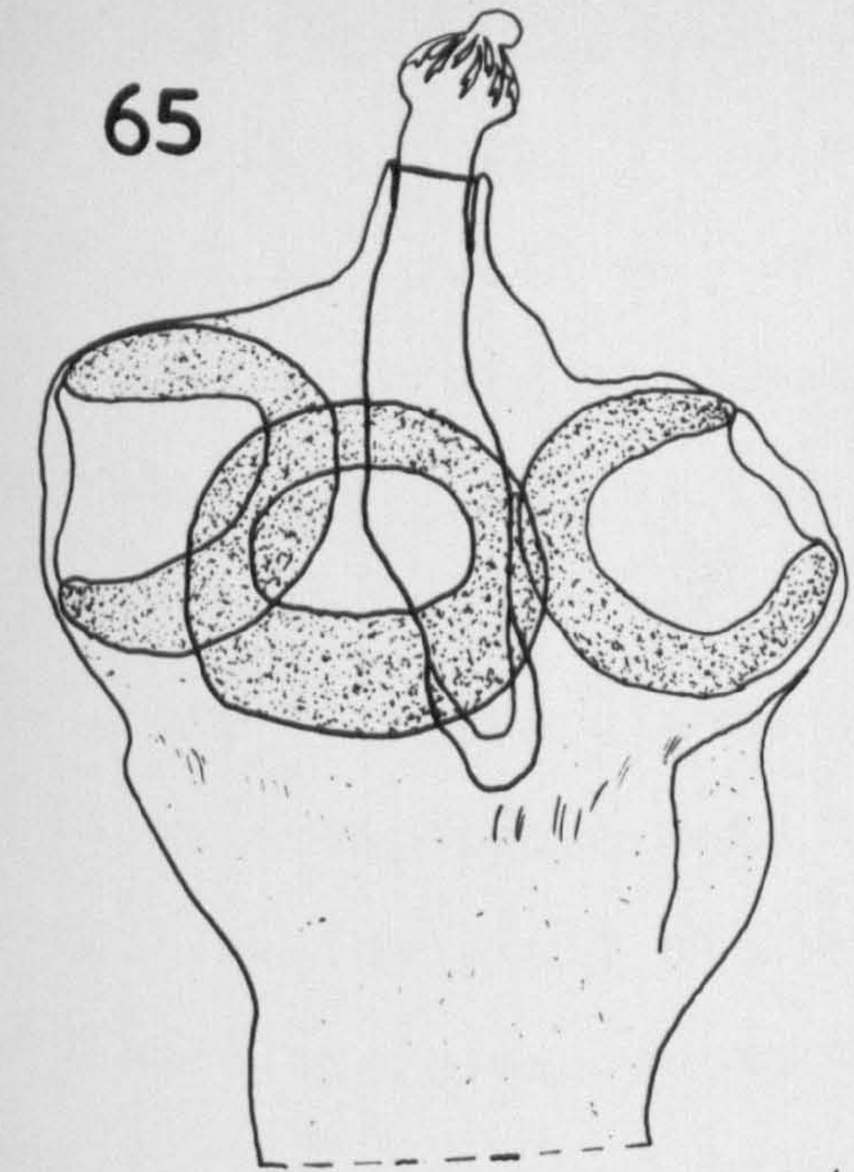
Figure 67. Mature segment. L.P. X 10.

Choanotaenia unicoronata (Fuhrmann, 1908)

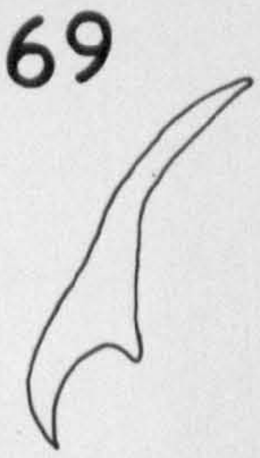
Figure 68. Scolex. H.P. X 6.

Figure 69. Hook. Oil.

Figure 70. Mature segment. H.P. X 6.


65
0·1 mm.

66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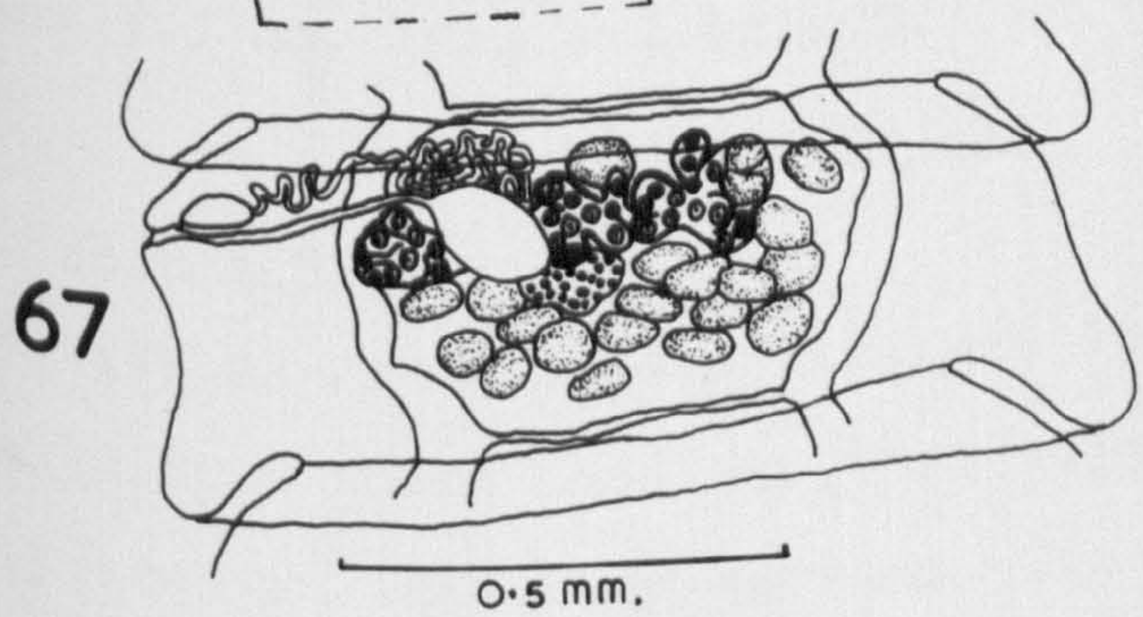
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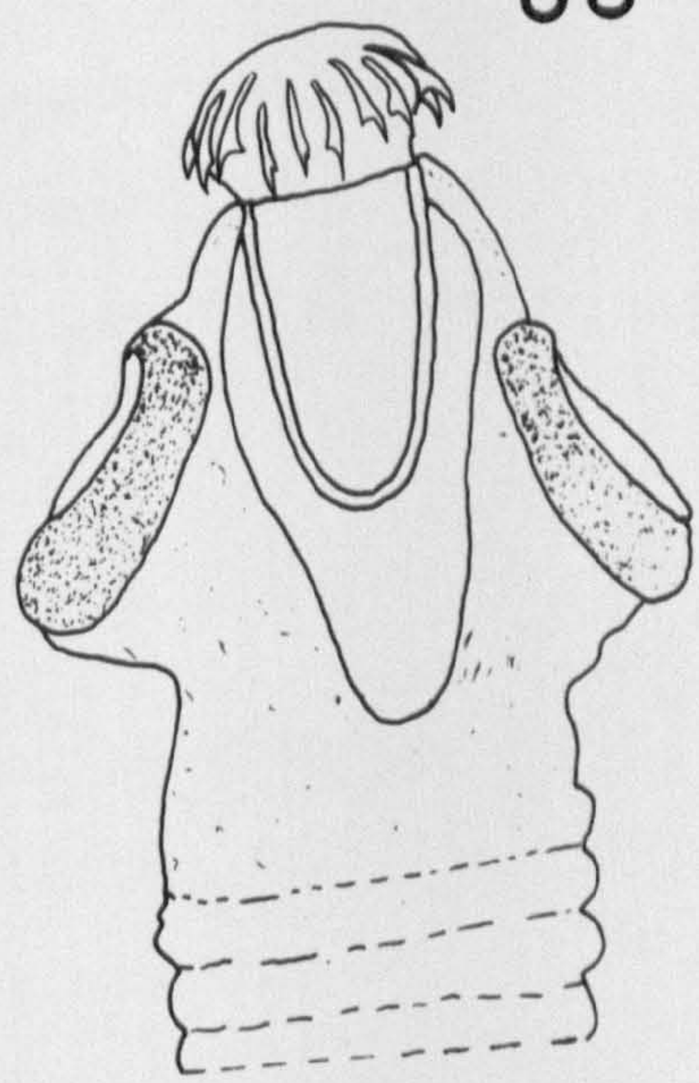
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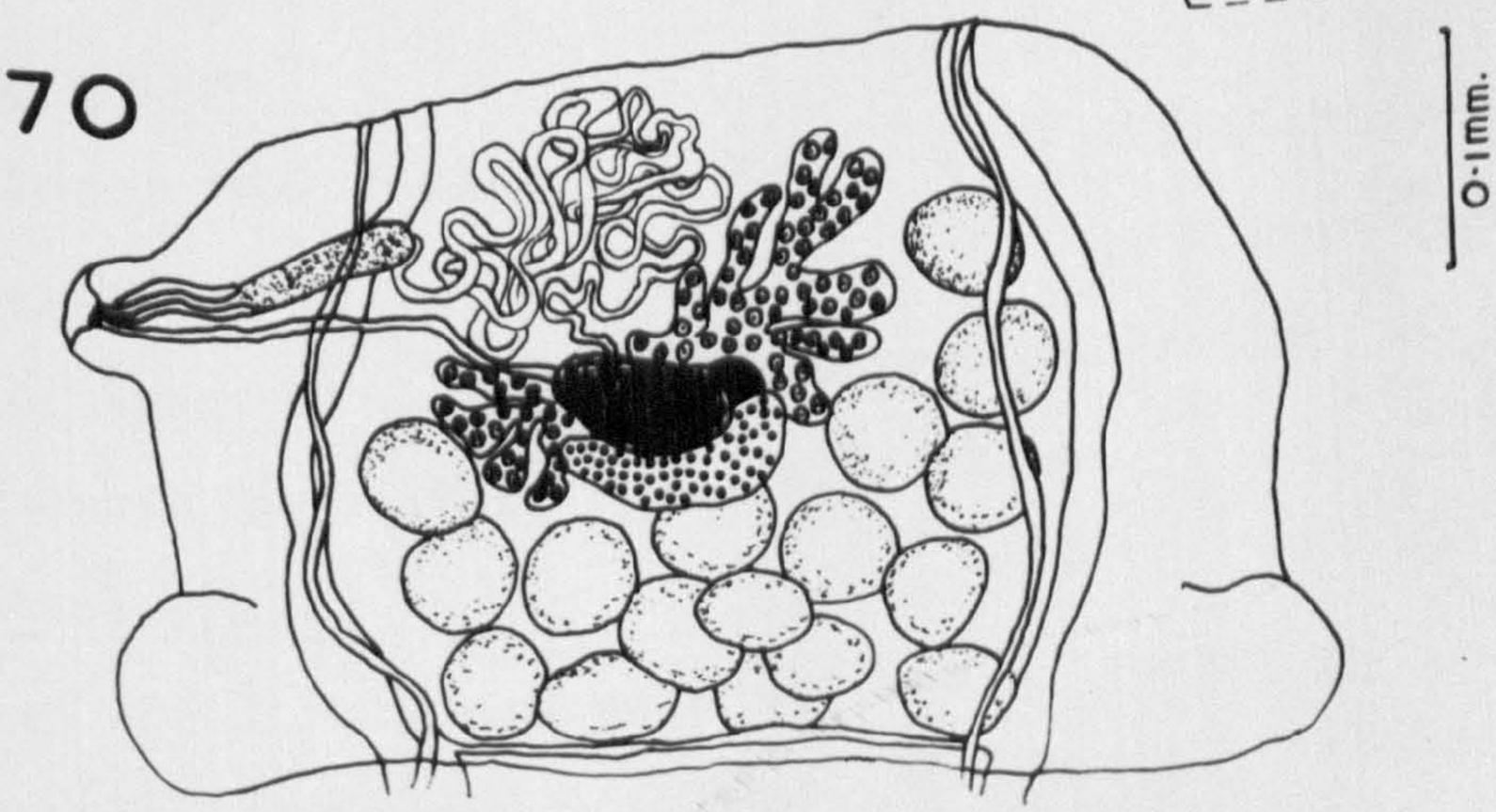
70
0·1 mm.

dimensions, but the writer's specimens do not show definitive genital development until at least the 105th. segment. Such a segment is far wider than long, being 0.47 mm. in diameter and only 0.07 mm. in length. The mature segment is generally broader than long, 0.284 mm. by 0.77 mm. although Williams (1956, unpubl.) found that his specimens have square proglottids on reaching maturity. The writer has noted that it is the gravid proglottids which are of near-equal dimensions, 0.525 mm. by 0.518 mm., but Williams states that these are again broader than long. In an exceptional case the "gravid" region was under-developed, i.e. the small uterus contained a few unfertilized eggs, and here there was enormous extension of the proglottid, which was 1.5 mm. long and only 0.3 mm. broad.

Internal Morphology

a). Musculature

Sectioning revealed two distinct layers of longitudinal muscles, with a third less distinct adjacent to the medulla, and are a typical in that they surround the female genitalia.

b). Excretory system

The smaller dorsal vessel, 0.009 mm. lies directly above, or in mature specimens slightly externally to the ventral vessel, 0.036 mm. The transverse vessel is compressed by the testes in the mature segments and rarely exceeds 0.012 mm.

c). Reproductive system

The testes are first to mature and are a typical in that they surround the female genitalia. There are between 15 and 23, round or oval in shape and between 0.052 mm. and 0.063 mm. in

diameter. From each small sperm ducts arise which fuse to join the vas deferens, which is next to reach maturation. Finally the small cirrus is formed. This does not reach the poral excretory vessel in any of the writer's specimens (Figure 67). López-Neyra (1944) and Williams (1956 unpubl.) state that it extends to just beyond the poral excretory canal. It is oval, 0.066 - 0.079 mm. by 0.035 - 0.04 mm. and is directed obliquely backwards. There is no obvious internal seminal vesicle at the proximal end. The cirrus is short and stout, and seems scarcely to protrude beyond the genital atrium. The maximum length was 0.035 - 0.04 mm. and it is 0.016 mm. wide. There are a few terminal spines. The genital atrium is irregularly alternate, not regularly alternate as stated by Williams. A sample length of strobila reveals atrial openings as follows: 1 R, 2 L, 3 R, 1 L, 1 R, 3 L. The atrium is not muscular, 0.016 mm. in diameter and 0.035 mm. deep. The shortness of the cirrus suggests that self-fertilization is not uncommon.

The vas deferens occupies the most anterior region of the segment and extends through many convolutions from the mid-line to the poral excretory vessels where it straightens out and passes between the dorsal and ventral canals. It is 0.006 mm. in diameter.

The vagina opens externally and ventrally to the cirrus sac, on the posterior face of the atrinal chamber. The opening is sphincter-like in its slight muscularity. The duct is 0.215 mm. long on average but only 0.006 mm. wide. It follows the course

of the vas deferens in that it runs obliquely forwards as it passes between the vessels. It then turns towards the mid-line and enlarges to form the receptaculum seminis. This is oval, 0.102 mm. by 0.065 mm.

On the dorsal side of the segment the bipartite lobed ovary can be determined. It does not take the carmine stains satisfactorily and is distinguishable only as a reddish mass masking the foremost testes. The follicular vitellaria are much more distinct and occupy the middle of the segment. Each is broader than long, 0.065 mm. by 0.102 mm. and is ventral to Mehlis' gland, which is found in a depression on the anterior dorsal surface. From Mehlis' gland, which is 0.050 mm. in diameter, the uterine tube emerges.

The uterus is sac-like and contains eggs in distinct uterine capsules. The actual ova are oval, approximately 0.021 mm. across and bear embryonic hooks 0.009 - 0.01 mm. long. The egg shell is rounded and in certain specimens seems to bear polar thickenings. It is only a little longer than the ovum, 0.027 - 0.029 mm. in diameter. The uterine capsule is irregular in shape, due to compression from adjacent capsules, but is 0.035 to 0.05 mm. in diameter. The capsule appears to be of a uniformly thick, cuticular nature. The enormous elongations of the capsule figured by Williams (1956 unpubl.) were not found. The teasing out of gravid material under oil immersion invariably resulted in the rupture of the capsule and the liberation of the egg.

Discussion

The species described above is clearly that which is found in

TABLE 24: Choanotaenia clavigera (Krabbe, 1869)

Characters		Lühe, 1910	Lopez-Neyra, 1944	Williams, 1956 (unpublished).	Author
Length of strobila		90.0	90.0	17.0	85.0
Maximum breadth		1.0	1.0	0.5	0.98
Scolex	Diameter	0.27 x 0.19	0.22 x 0.3	0.27 x 0.48	0.132 - 0.212
Rostellum	Length	-	0.17	0.29	0.132 - 0.232
	Breadth	-	-	-	0.024 - 0.027
	Bulb diameter	-	0.055 - 0.08	0.055 - 0.068	0.042 - 0.048
Hooks	Size	(a)0.019 - 0.026 (b)0.021 - 0.028	(a)0.024 - 0.026 (b)0.026 - 0.03	(a)0.027 - 0.028 (b)0.028 - 0.03	(a)0.02 - 0.022 (b)0.026 - 0.029
	Number	20 - 22(2)	20 - 24(2)	22(2)	20 - 22(2)
Suckers	Diameter	0.12 - 0.15	-	-	0.16 - 0.178
Early segment	Length	-	-	-	0.07
	Breadth	-	-	-	0.47
Mature segment	Length	-	-	-	0.284
	Breadth	-	-	-	0.77
Gravid segment	Length	-	-	-	0.525
	Breadth	-	-	-	0.588
Excretory	Dorsal	-	-	-	0.089
	Ventral	-	-	-	0.036
Genital atrium		Regularly alternated			
Testis	Number	25 - 30	20 - 26	16 - 18	15 - 23
	Size	0.028	-	-	0.052 - 0.063
Cirrus sac	Length	-	0.06 - 0.13	0.087 - 0.111	0.079
	Diameter		0.02 - 0.025	-	0.035 - 0.04
Cirrus	Length	-	-	0.11	0.035 - 0.04
	Breadth	-	-	-	0.16
Vagina		-	-	-	0.215 x 0.006
Receptaculum seminis		-	-	-	0.138 x 0.075
Ovary		-	-	-	-
Vitellaria		-	-	-	0.102 - 0.065
Envelope		-	-	0.04 - 0.046	0.027 - 0.029
Ova		-	0.018 - 0.02	0.029 - 0.036	0.021
Hooks		-	0.009 - 0.01	0.012 - 0.015	0.009 - 0.01

most text-books as clavigera (Krabbe, 1869). Table 24 shows the writer's measurements together with two recent redescriptions and an earlier one by Lühe (1910). The most marked difference is the smaller scolex and cirrus sac. This last feature is constant in all the writer's material. The species clavigera (Kr.1869) has been persistently shifted from Anomotaenia to Choanotaenia and back again by successive workers, and satisfied that the above material was most aptly ascribed to Choanotaenia, the writer took the opportunity to mention this to M. I. Sandeman who had placed his material under Anomotaenia in his survey of the Dilepids of Charadriiforms. In fairness, Sandeman had utilized the double row of rostellar hooks as his main criterion for Anomotaenia, suppressed Choanotaenia and retained only those species with a distinctive parenchymatous capsule under Monopylidium. In this scheme, clavigera belongs in Anomotaenia. Sandeman claimed that if one worked according to the existing criteria (i.e. Fuhrmann's 1932) then it was possible to find specimens both with and without uterine capsules and stated that there was also a constant difference of 2μ in the rostellar hooks! The implications to be drawn from this statement will appear below.

The conversation ended with a promise to supply a slide containing both types of scolex and uterus, The slides were not received and a letter of reminder produced no result. While these as yet unpublished results of Sandeman would appear to justify the various workers whose material has caused them to utilize one or other genus, the writer's specimens belong under Choanotaenia.

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On a New Cestode, *Choanotaenia larimarina* sp. nov., from the Greater Black-backed Gull, *Larus marinus* L.

By J. Brian Elce

From the Department of Parasitology, London School of Hygiene and Tropical Medicine

A greater black-backed gull, *Larus marinus* L. was shot at Monkstone Point, Saundersfoot, Pembrokeshire in March 1961. The intestine was impacted with a tangled mass of cestodes which on examination revealed *Aploparaksis cirrosa** (Krabbe 1869), *Tetrabothrius cylindraceus* (Rudolphi, 1819), *Tetrabothrius erostris* (Lönnberg, 1889), and the species which forms the basis of this paper.

Description

About thirty specimens of *Choanotaenia larimarina* sp.nov. were recovered. They are creamy white in appearance and reach a length of 10·7 cm. (average 7–8 cm.). There are some 250 segments in a strobila, the individual segments undergoing considerable elongation at the posterior end. The maximum length of a gravid segment is 2·7 mm. while the maximum breadth is 1 mm.

The scolex (Fig. 1) has a diameter of 0·345–0·548 mm. and a length, which does not include the neck, of 0·7 mm. The rostellum is 0·322–0·534 mm. long and has a diameter of 0·063–0·07 mm. It bears a double crown of 20 hooks all measuring 0·1 mm. The rostellum sac measures 0·13 mm. by 0·35 mm. while the rostellum bulb measures 0·098–0·113 mm. The muscular suckers tend to be anteriorly directed and have a diameter of 0·148–0·21 mm. Segmentation occurs after a short neck of about 0·2 mm.

The genital pores are irregularly alternated, situated in the anterior quarter of each segment and even in some mature segments tend to be covered by the overlap from the preceding segment.

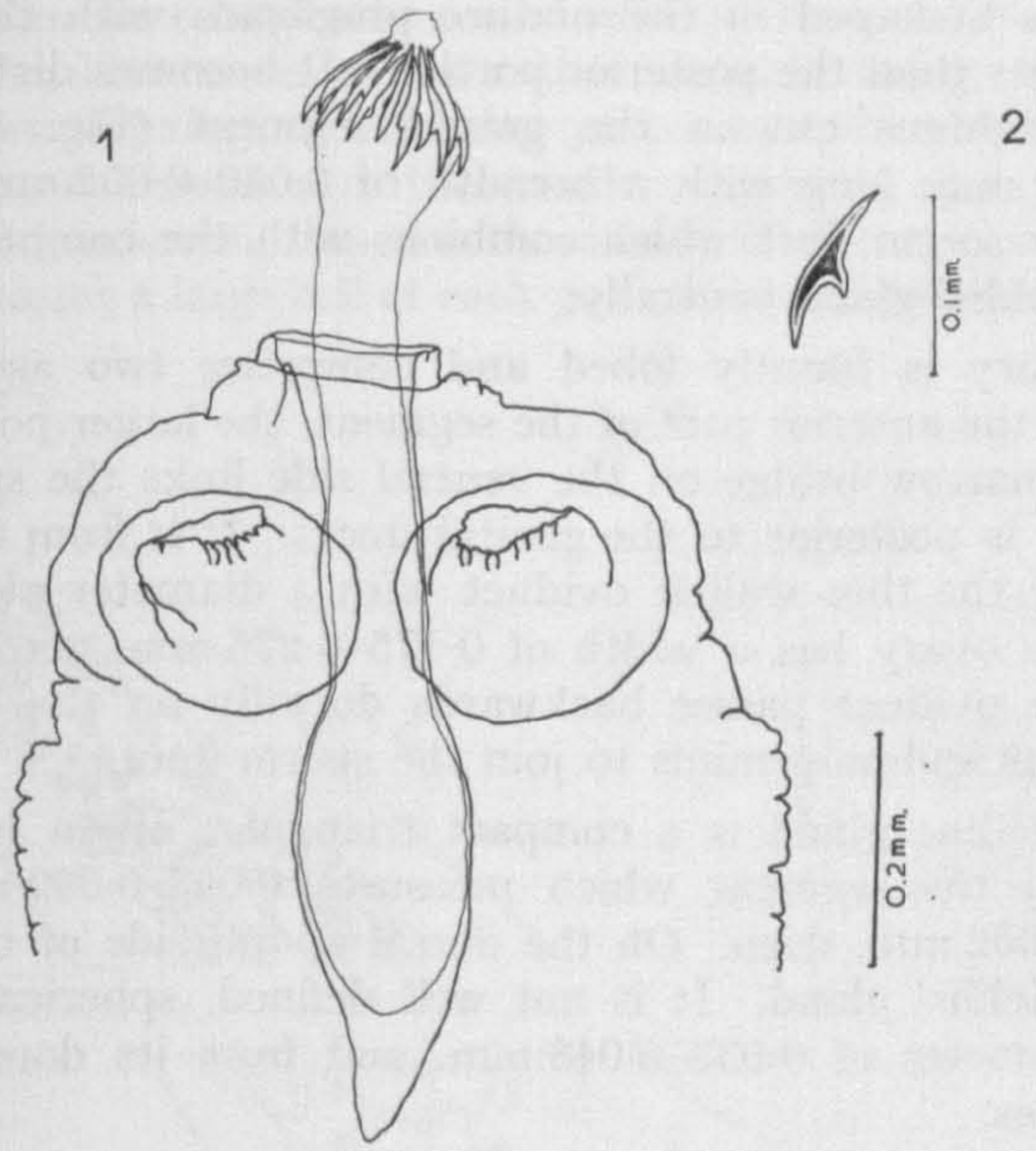
* This is the first British record of *A. cirrosa* from *Larus marinus* and only the second record from *Larus* spp. in British waters.

The genital atrium itself is non-muscular with a length of 0·033 mm. and a width of about 0·008 mm. There are two pairs of longitudinal excretory vessels, the ventral pair being very variable in diameter (0·02–0·049 mm.) while the dorsal pair are more uniform in diameter (0·006–0·009 mm.). The ventral vessels are connected in the posterior part of each segment by a transverse vessel with a diameter of 0·02–0·033 mm. The transverse vessels and the dorsal vessels atrophy in the gravid segments.

The genital primordia are patent by the fortieth segment and both sets of organs develop simultaneously. There are 26 to 36 testes in the posterior half of each mature segment (Fig. 3). They are elongated dorsoventrally and measure 0·033–0·052 mm. by 0·1–0·115 mm. The vasa efferentia from each testis join in the region posterior to the receptaculum seminis to form the vas deferens. This passes over the dorsal surface of the posterior portion of the receptaculum seminis to the aporal side and dips ventrally under the ovary to re-emerge, greatly coiled in the anterior poral third of each segment (Fig. 4). The vas deferens then passes between the longitudinal vessels to join the cirrus pouch. Its diameter varies along its length from 0·011–0·015 mm.

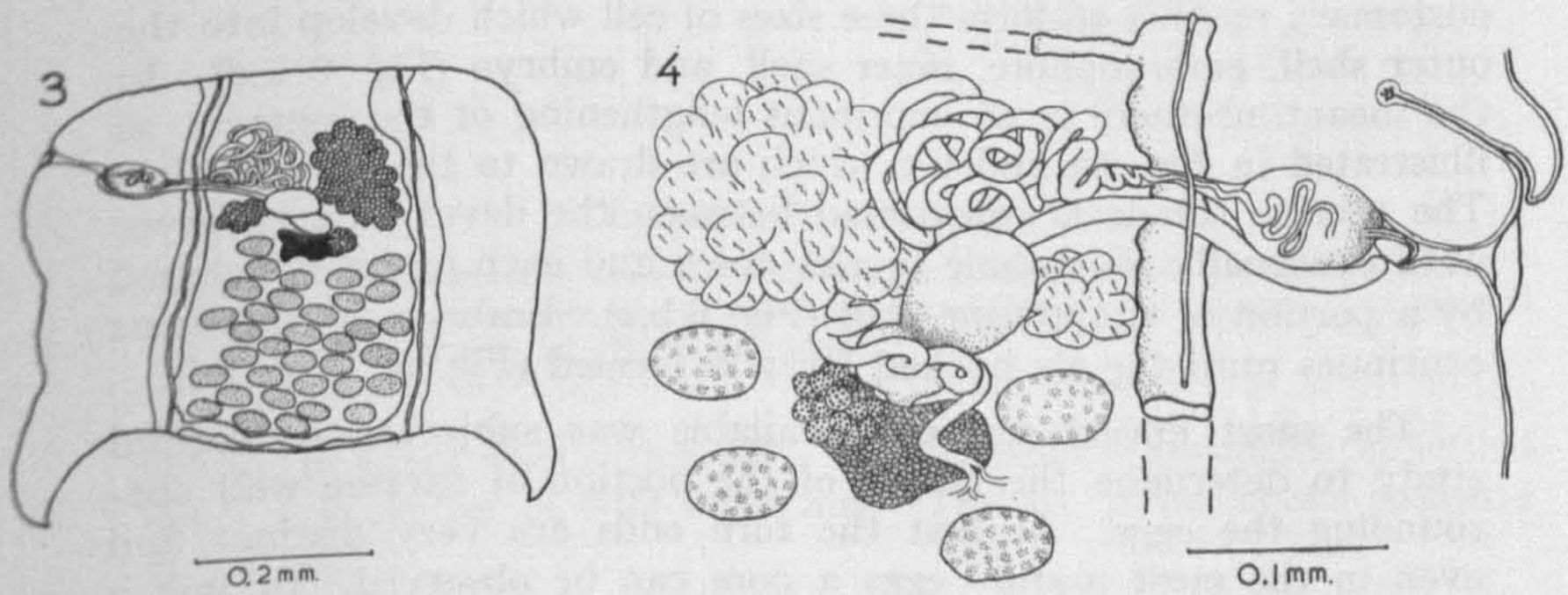
The cirrus pouch is small with an interval of at least 0·025 mm. between its inner extremity and the ventral excretory vessel. It is weakly developed varying in length from 0·066–0·093 mm. (average 0·073 mm.) with a diameter of 0·033–0·045 mm. The cirrus itself is not easily studied and appears as a narrow, smooth and hook-shaped tube. It is unarmed with a diameter of 0·005 mm. The maximum observed length was 0·04 mm. and it was impossible to estimate whether this was it fullest extension. It was still enclosed in the genital atrium with the hook-like curve directed towards the vaginal opening. This fact, together with the covering of the genital atrium by the posterior edge of the preceding segment suggests self fertilization. The cirrus pouch appeared to possess some chitinization around the base of the cirrus.

The vagina opens posteriorly and ventral to the cirrus pouch and as it passes inwards it moves dorsally. It is a thick walled tube of length 0·266 mm. and diameter 0·016 mm. As it approaches the receptaculum seminis it tends towards an increased diameter of up to 0·024 mm. This distension is particularly marked in many of the late mature and gravid segments. The internal diameter of the vagina is 0·011–0·012 mm. The receptaculum seminis is extremely well developed, far more so than in several species of *Anomotaenia* and *Choanotaenia* examined in connexion with this



Choanotaenia larimarina sp.nov.

Fig. 1.—Scolex. Fig. 2.—Hook.



Choanotaenia larimarina sp.nov.

Fig. 3.—Mature segment. Fig. 4.—Detail of genital organs and ducts.

work. It is S-shaped in the mature proglotids with the anterior portion larger than the posterior portion. It becomes distended and finally straightens out in the gravid segment (Fig. 5b). It is 0·066–0·082 mm. long with a breadth of 0·040–0·052 mm. It narrows into a sperm duct which combines with the common oviduct to enter Mehlis' gland ventrally.

The ovary is bluntly lobed and comprises two asymmetrical portions in the anterior part of the segment, the larger portion being aporal. A narrow bridge on the ventral side links the smaller portion which is posterior to the genital ducts. It is from this narrow bridge that the thin walled oviduct with a diameter of 0·008 mm. arises. The ovary has a width of 0·175–0·275 mm. across the segment. The oviduct passes backwards dorsally on the aporal side of the receptaculum seminis to join the sperm duct.

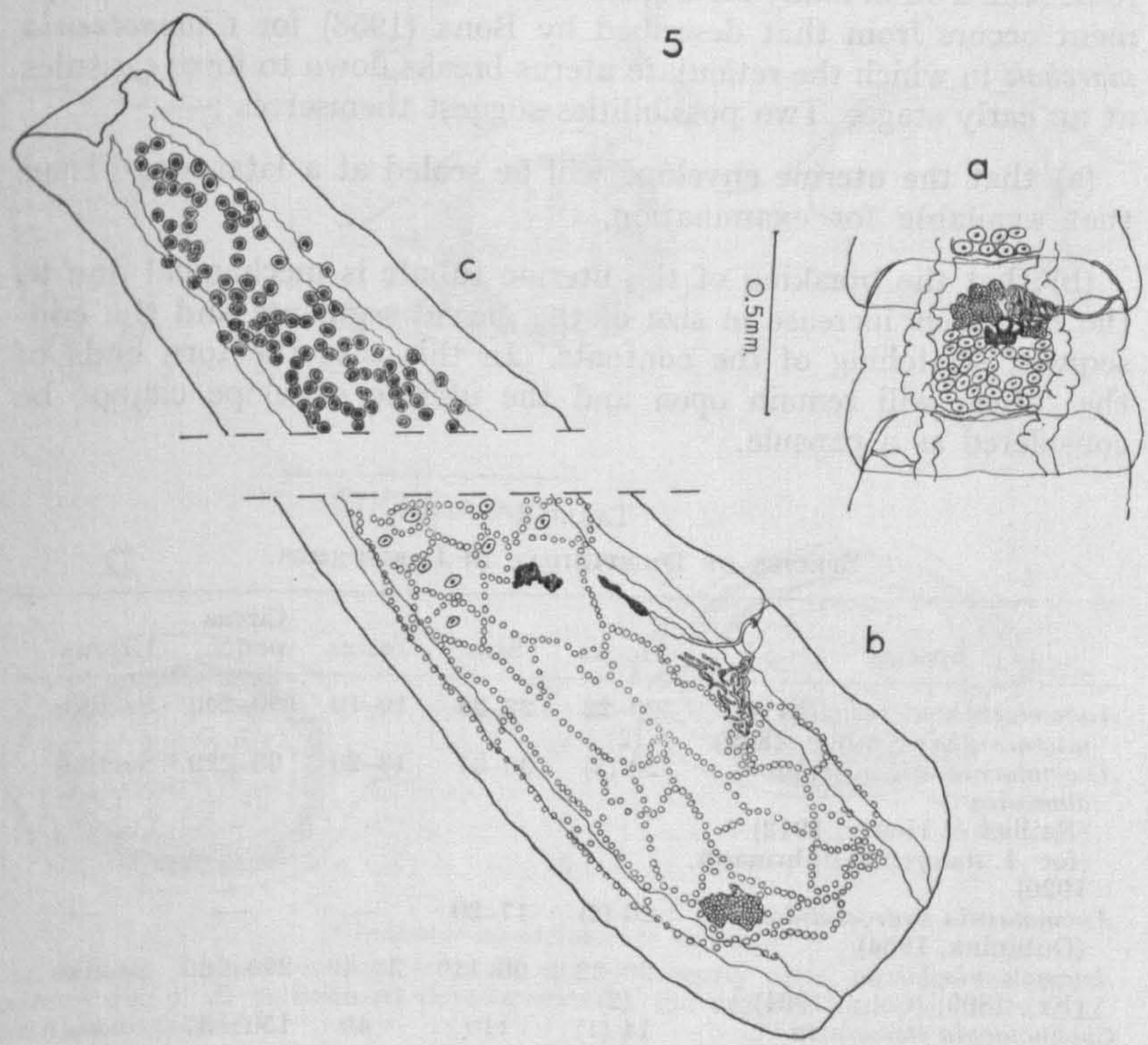
The vitelline gland is a compact triangular organ lying in the mid-line of the segment which measures 0·063–0·099 mm. across by 0·04–0·052 mm. deep. On the dorsal aporal side of the vitelline gland is Mehlis' gland. It is not well defined, spherical, follicular with a diameter of 0·033–0·048 mm. and from its dorsal side the uterus arises.

The uterus which passes forwards and downwards from Mehlis' gland is recognisable at first as a reticulate arrangement of small deeply staining cells. Maturation is very rapid and a definite network of thin walled tubes containing fertilised eggs is to be found, corresponding to Figs. 5b and 6a. The reticulate uterus is in the ventral part of the segment and it extends laterally beneath the ventral excretory vessels. The development of the eggs has been carefully studied under oil immersion. The embryo divides in the customary manner to form three sizes of cell which develop into the outer shell, embryophore, inner shell, and embryo (Fig. 6 b,c). In the meantime there is an enormous lengthening of the segment as illustrated in Fig. 5a and b-c which are drawn to the same scale.* The uterine tubule is constricted between the developing embryos until eventually the tubule breaks down and each egg is enveloped by a portion of the uterine wall (Fig. 6 b,c). Embryo development continues until the six hooked larva is formed (Fig. 5c, Fig. 6d).

The most gravid segment available was subjected to careful study to determine the nature of the portion of uterine wall surrounding the eggs. At first the torn ends are very distinct and even in the most mature eggs a pore can be observed. In just a few cases however no pore was found which would indicate that the

* Fig. 5b is diagrammatic. The testes and relevant egg stage would normally be found in a smaller segment than that illustrated.

contents can be completely sealed off and that a distinct envelope is formed. This envelope is rather delicate being easily broken during normal fixing and staining processes and especially in efforts to dissect out a section of the tubule containing eggs. The mature egg (Fig. 6d) is lemon shaped with an outer shell measuring 0·066 mm. which contains a large cell at each pole. The embryophore is granular



Choanotaenia larimarina sp.nov.

Fig. 5.—Two segments drawn to the same scale (a) early mature, (b) early development of reticulate uterus and atrophy of the genital organs superimposed on a gravid segment, (c) gravid segment.

while the inner shell is delicate. The oncosphere is roughly spherical with a diameter of 0·03–0·033 mm. The six larval hooks measure 0·018 mm.

There are two layers of longitudinal muscle fibres. In the inner layer each bundle comprises 6–10 fibres while in the outer layer each bundle comprises 4–6 fibres.

Discussion

The meaning of "uterine capsules" in the genus *Choanotaenia* is not clear and it is dubious whether the species under discussion should be considered as possessing such capsules since there is an apparent lack of protective function and the contents do not appear to be sealed off in many instances. Certainly a very different development occurs from that described by Bona (1958) for *Choanotaenia marchali* in which the reticulate uterus breaks down to form capsules at an early stage. Two possibilities suggest themselves :—

(a) that the uterine envelope will be sealed at a later stage than that available for examination,

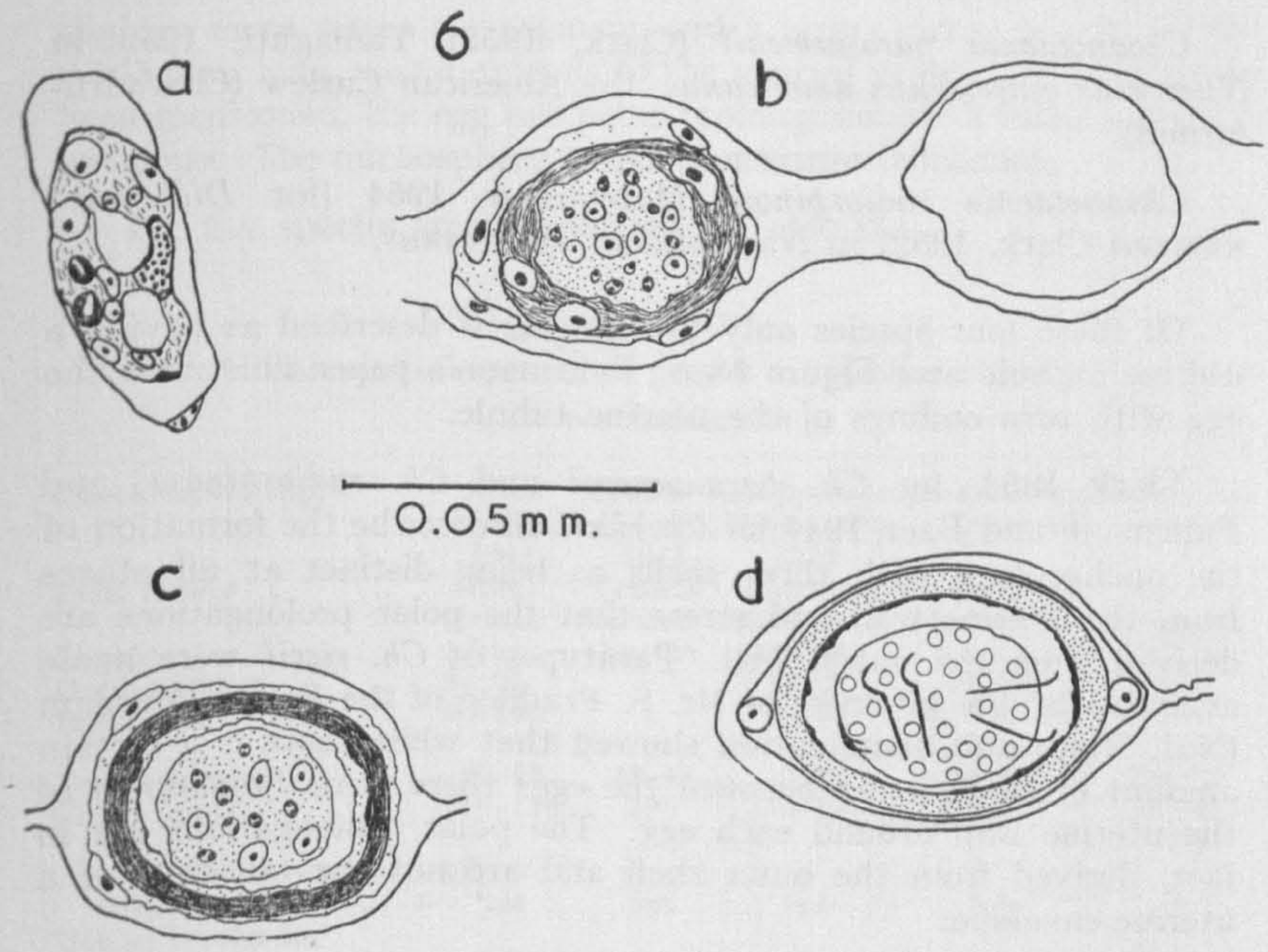
(b) that the breaking of the uterine tubule is mechanical due to the enormous increase in size of the gravid segments and the consequent stretching of the contents. In this case the torn ends of the tubule will remain open and the uterine envelope cannot be considered as a capsule.

Table I

Species of Dilepididae in Lariformes

Species	Hooks	Size	Testes	Cirrus pouch	Uterus
Anomotaenia micracantha micracantha (Krabbe, 1869)	20–22 (2)	22–38	10–16	150–200	Saclike
Anomotaenia micracantha dominica (Railliet et Henry, 1912) (for *A. antarctica* Fuhrmann, 1920)	20 (2)	30–37	13–20	98–229	Saclike
Anomotaenia hydrochelidonis (Dubinina, 1954)	20 (2)	17–20	—	—	—
Anomotaenia larina (Kr., 1869) (Cohn, 1901)	20–22 (2)	96–110	30–40	240–280	Saclike
Choanotaenia stercoraria (Baylis, 1919)	14 (1)	110	40	150×37	—
Choanotaenia aurantia (Singh, 1956)	14–18 (1)	14–19	16–20	112–196	—
Choanotaenia larimarina sp.nov.	20 (2)	100	26–36	66–93 (73)	Reticulate
Paricterotaenia dodecacantha (Krabbe, 1869)	12 (1)	73–78	12–15	183–297	Saclike
Paricterotaenia gongyla (Cohn, 1900)	12–14 (1)	105–125	36–48	110–225	Saclike
Paricterotaenia inversa (Rudolphi, 1819)	16 (1)	15–17	11–16	68–136	Saclike
Paricterotaenia porosa (Rudolphi, 1819)	14 (1)	108–112	15–35	413–550	Saclike
Paricterotaenia sternina (Krabbe, 1869)	14–16	43–46	13–15	274	Saclike

The presence of a reticulate uterus and a uterine envelope suggests that this species should be included in the genus *Choanotaenia*. Only two species of *Choanotaenia* have been reported from the family Laridae, namely *Ch. stercoraria* (Baylis, 1919) from the pomarine skua, *Stercorarius pomarinus*, and *Ch. aurantia* Singh, 1956 from the river tern, *Sterna aurantia*. The former differs from the species



Choanotaenia larimarina sp.nov.

Fig. 6.—(a) Transverse section of an embryo shortly after cleavage has commenced (b, c, d) subsequent development of the embryo and constriction of the uterine tubule.

under discussion in having 14 hooks of 0·11 mm. in a single row, a much larger cirrus pouch (0·150 by 0·037 mm.) and there is no mention of a reticulate uterus. The latter differs in having 14–18 hooks of 0·014–0·019 mm. in a single row, a much larger cirrus pouch (0·112–0·196 by 0·018–0·028 mm.) and again there is no mention of a reticulate uterus.

A list of species from the genera *Anomotaenia, Choanotaenia,* and *Paricterotaenia* which are found in the Laridae is given in Table I.

The members of the genus *Choanotaenia* in which a reticulate uterus has been found are :—

Choanotaenia riccii Fuhrmann and Baer, 1944 in *Sphenorhyncus abdimii*, the white bellied stork from Africa (Ardeiformes).

Choanaotaenia upupae Fuhrmann, 1943 in *Upupa africana*, the African Hoopoe (Coraciiformes).

Choanotaenia paranumenii (Clark, 1952) Yamaguti, 1959 in *Numenius americanus americanus*, the American Curlew (Charadriiformes).

Choanotaenia radiospinosa Matevosian, 1954 (for *Dictymetra numenii* Clark, 1952) in *Numenius a. americanus*.

Of these four species only *Ch. upupae* is described as having a uterine capsule and Figure 18 of Fuhrmann's paper illustrates the egg with torn endings of the uterine tubule.

Clark 1952, for *Ch. paranumenii* and *Ch. radiospinosa*, and Fuhrmann and Baer, 1944 for *Ch. riccii* all describe the formation of the onchosphere with three shells as being distinct at all stages from the uterine wall and stress that the polar prolongations are derived from the outer shell. Paratypes of *Ch. riccii* were made available by the kindness of Mr. S. Prudhoe of the British Museum (Nat. Hist.) and examination showed that while there is a certain amount of constriction between the eggs there is no breakdown of the uterine wall around each egg. The polar prolongations are in fact, derived from the outer shell and are not the tail ends of a uterine envelope.

With regard to the development of the egg, the new species is closest to *Ch. upupae* but it differs from it in that Fuhrmann describes only two shells and hooklets which measure 0·014 mm. while *Ch. larimarina* sp.nov. has three shells and hooklets of 0·018 mm. Differences in general anatomy include a much larger cirrus pouch (0·2 mm.), prostatic cells around the vas deferens, a larger ovary and vitelline gland, and a larger number of testes in *Ch. upupae*. *Ch. riccii* differs from *Ch. larimarina* sp.nov. in having 24 hooks of 0·096–0·110 mm. in a double crown, a larger cirrus pouch, fewer testes and an egg which possess polar prolongations and is devoid of a uterine envelope.

Both *Ch. paranumenii* and *Ch. radiospinosa* were described as possessing an apical pore and a series of small radiating scales on the rostellum. These have not been found on *Ch. larimarina*.

Ch. radiospinosa has 24 hooks of 0·065–0·068 mm. distributed in two rows, 15–17 testes and a cirrus pouch of 0·146–0·190 mm. long by 0·023–0·035 mm. wide. The eggs have polar prolongations each of which contains a large spherical cell. Morphologically *Ch. larimarina* overlaps *Ch. paranumenii* very closely, but while the latter species also has 20 hooks arranged in two rows, they can be differentiated in that the anterior row measures 0·1–0·105 mm. and the posterior row measures 0·11–0·115 mm. *Ch. paranumenii* has slightly more testes per segment and a larger cirrus pouch, 0·132–0·165 mm. long, which extends to the ventral vessel. As has already been mentioned, the egg has polar prolongations but lacks a uterine envelope. The onchosphere hooklets measure 0·023 mm.

The five species are summarised in Table II.

TABLE II

Choanotaenia spp. which possess a reticulate uterus

(*All measurements in* μ)

Choanotaenia spp.	*riccii* F. & B., 1944	*upupae* Fuhrm., 1943	*radiospinosa* Matevosian, 1954	*paranumenii* (Clark, 1952)	*larimarina* sp.nov.
Host family	Ardeiformes	Coraciiformes	Charadriiformes	Charadriiformes	Lariformes
Locality	Africa	Angola	America	America	Wales
Hook number ...	24 (2)	?	24 (2)	20 (2)	20 (2)
Hook size	90–106	?	65–68	(a) 100–105 (b) 110–115	100
Testes number ...	20–22	42–48	15–17	35–40	26–36
Cirrus pouch	115–116	200	146–190	132–165	66–93 (73)
extending to ventral vessel	yes	yes	yes	yes	no
Uterus breaks to envelop embryo ...	no	yes	no	no	yes
Egg with polar prolongations ...	yes	no	yes	yes	no
Hooklet size ...	23	14	17	23	18

CONCLUSIONS

It is evident that these five species form a compact subgroup within the genus *Choanotaenia* and it is possible that the breakdown of the uterine wall may be a fluid character within the group. Whether the portions of uterine wall do become sealed to form a capsule in *Ch. upupae* and *Ch. larimarina* is open to doubt since this has not been observed often in the latter species. In distinguishing the species the number and size of the hooks on the rostellum, the testes number, the size of the cirrus pouch and the

possession or absence of polar prolongations should be considered more important than the breakdown of the uterus which may well be mechanical.

The specific name *larimarina* has been chosen because this is the first record of a *Choanotaenia* species from the greater black-backed gull.

Summary

1. A new species *Choanotaenia larimarina* sp.nov. from the greater black-backed gull (*Larus marinus*) is described.

2. A comparison is made with other species of *Choanotaenia* which possess a reticulate uterus.

3. Because the uterus breaks down in only one of these four species it is suggested that in this type of development the breakage may be due to mechanical stretching of the tubule in the gravid segment.

4. If this be true then the portion of the uterine wall which envelops the egg is not a uterine capsule in the accepted sense.

Acknowledgments

The writer wishes to thank Professor J. J. C. Buckley for overall supervision of the work. With regard to this particular species Mr. S. Prudhoe of the British Museum has given great help and encouragement in putting Museum material at the writer's disposal. Mr. F. R. N. Pester and Mr. B. Cheetham have given both technical advice and assistance. Finally Mr. J. McLoughlin of Saundersfoot, whose marksmanship provided the original material, must be thanked.

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18). Choanotaenia unicoronata (Fuhrmann, 1908) Fuhrmann, 1932

syn. Monopylidium unicoronata Fuhrmann, 1908.

Anomotaenia unicoronata (Fuhrmann, 1908) Clerc, 1911.

Choanofuhrmannia unicoronata (Fuhrmann, 1908) Lopez-Neyra, 1935.

Fuhrmann (1908) described Monopylidium unicoronata from the Blackbird (Turdus merula L.). It was transfered to the genus Anomotaenia by Clerc (1911) and to Choanotaenia by Fuhrmann (1932) when he suppressed the genus Monopylidium. In 1935, López-Neyra created a new genus Choanofuhrmannia, because he considered it to have two or three eggs per uterine capsule. He retracted this genus later and the most recent redescription, that of Mettrick (1958), reaffirms the occurrence of a single egg per capsule.

Mettrick found the cestode in the Songthrush (Turdus philomelos clarkii Hartert) and the Missel Thrush (Turdus viscivorus L.). The writer found two incomplete strobilae in a female Blackbird which had frozen to death in January 1962. Both were stained and mounted.

External Morphology

Both strobilae were very short, 13.3 mm. and 18 mm. respectively. The worms were discoloured and did not absorb the stain easily. The maximum breadth of a mature proglottid was 0.518 mm.

The scolex is very well developed with a diameter of 0.25 - 0.27 mm. and bears four muscular, unarmed suckers, 0.135 mm. long and 0.099 mm. across (Figure 68). The stout rostellum is 0.19 mm. long and 0.072 mm. broad. The terminal bulb is 0.1 mm. in diameter and bears 20 hooks in a double row 0.038 mm. long in the smaller

specimen and 0.044 mm. in the larger (Figure 69). There is no significant difference in length between the two rows. The capacious rostellar sac is 0.241 mm. long and 0.115 mm. in diameter. A short neck, 0.142 mm. long leads to the region of segmentation. A typical mature segment is 0.312 mm. long and 0.518 mm. across (Figure 70). There were no gravid segments.

Internal Morphology

a). Musculature

It was not possible to take sections from such inadequate material.

b). Excretory system

The dorsal vessel is 0.007 mm. wide and the ventral, 0.027 mm. wide. The transverse vessel, which is very much obscured by the testes, is roughly 0.008 - 0.01 mm. in diameter.

c). Reproductive system

The genital atria are irregularly alternate and in the mature segments are raised on distinctive prominences, 0.05 mm. by 0.055 mm. There are about 20 testes in the posterior half of the segment varying from 0.025 mm. to 0.04 mm. in length. The vas deferens is found either in the mid-line, or on the poral side of the same at the anterior end of each segment. It is 0.008 mm. in diameter and leads to an elongate cirrus pouch which runs obliquely backwards between the excretory vessels to open into the genital atrium. It is 0.132 mm. long and 0.018 mm. wide. There is no external seminal vesicle and a slight swelling at the proximal end serves for the internal vesicle. An extended cirrus was not observed.

TABLE 25: Choanotaenia uhlicoronata (Fuhrmann, 1908)

Characters		Fuhrmann, 1908	Nettrick, 1958	Auther
Length of strobila		12.0 - 15.0	22.0	18.0
Maximum breadth		0.8	1.01	0.518
Scolex	Diameter	0.29 - 0.33	0.32 - 0.33	0.27
Rostellum	Length	-	-	0.19
	Breadth	-	0.1 - 0.11	0.072
	Bulb diameter	-	-	0.1
Hooks	Number	22(1)	20(2)	20(2)
	Size	0.048	0.042 - 0.046	0.038 - 0.044
Rostellar sac		-	-	0.249 x 0.115
Suckers -	Diameter	0.13	0.12 - 0.125	0.135 x 0.099
Mature Segment	Length	-	-	0.312
	Breadth	-	-	0.518
Excretory	Dorsal	-	0.006 - 0.01	0.007
	Ventral	-	0.015 - 0.02	0.027
Genital atrium		Irregularly alternated		
Testis	Size	-	-	0.05 x 0.055
	Number	20 - 24	18 - 22	20
Cirrus sac	Size	0.068	0.017 - 0.025	0.04 - 0.05
	Length	0.14	0.14	0.132
	Diameter	0.028	0.024 - 0.028	0.018
Receptaculum seminis		-	-	0.06 x 0.03
Ovary		0.36	-	0.09
Vitelleria		0.13	0.09 - 0.111	0.075
Envelope		-	0.036 - 0.04	-
Ova		-	0.023 - 0.024	-
Hooks		-	0.012 - 0.014	-

The ovary is ventral and bilobed, 0.09 mm. across, with the greater number of follicles being found on the aporal side. The vagina opens posteriorly to the cirrus and runs a parallel course between the vessels before expanding to form the receptaculum seminis. In the most mature segment this was 0.06 mm. by 0.03 mm. The vitelline gland is 0.075 mm. across and Mehlis' gland is 0.03 mm. in diameter.

There were no gravid segments so that uterine development cannot be described.

Discussion

Table 25 shows the measurements of the material which formed the basis of Mettrick's recent redescription. Apart from the smaller size of the specimens as a whole, due to their immaturity, the only differences that need be emphasised are the smaller size of the rostellar hooks and the far larger size of the testes - virtually twice the diameter recorded by Mettrick. Fuhrmann's measurements are larger again.

This is apparently the first record from the Blackbird (*Turdus merula* L.) in Britain and the first record of *Choanaotaenia unicoronata* (Fuhrmann, 1908) in any host in Wales.

The family Dilepididae Railliet et Henry, 1909

The three sub-families are for the most part easily differentiated; the Dilepidinae Fuhrmann, 1907, genera posses a sac-like uterus, the Dipylidiinae Stiles, 1896, a reticulate or sac-like uterus in which one or several eggs are encapsulated, and the Parauterininae Fuhrmann, 1907 conspicuous para-uterine organs. On the generic level, there is much difficulty in placing members of Anomotaenia Cohn, 1900, Choanotaenia Railliet, 1896 and Paricterotaenia Fuhrmann, 1932 into the respective subfamily, so inconsistent is the treatment by previous taxonomists, the interpretation of the term 'uterine capsule' and the means of determination whether a rostellar crown is composed of one row of hooks or two. It is customary to follow Fuhrmann's definition (1932) of the three genera - and despite more recent work exposing the fallaciousness of his classification, the writer has felt obliged to conform in the descriptive passages above, because of its relative simplicity. It may be summarised thus:-

S.F.Dilepidinae(Persistent uterus) S.F.Dipylidiinae(Egg capsules)
Paricterotaenia (1 row of hooks) Choanotaenia (1 or rows hooks)
Anomotaenia (2 rows of hooks)

It is essential to consider the classification of the Dilepids prior to 1932. The genus Anomotaenia was created by Cohn (1900) with microrhyncha (Kr. 1869) as type and its generic definition remained unchanged by Fuhrmann. The genus Choanotaenia was named by Railliet (1896) with T. infundibuliformis Goeze, 1780 as type, and was distinguished from Anomotaenia by early taxonomists on the basis of its single crown of hooks. Both

possessed a persistent sac-like uterus. Fuhrmann (1899) established Monopylidium with M. musculosum (Fuhrmann, 1896) as type for those species with similar morphology to, but differing from Choanotaenia in that there are one or more rows of hooks and the uteri break down into egg capsules. With regard to musculosum, he described four distinct coverings to the ova. The inner two he ascribed to the embryo, the third layer he related to adjacent, transformed parenchyma cells and the fourth layer to partial resorption of the uterine wall. He moved infundibulum (Bloch, 1779) which had replaced infundibuliformis as genotype, to the new genus because it formed similar capsules and proposed galbulae Gmelin, 1790 as the new type for Choanotaenia. For many years the discussion continued as to whether infundibulum does form capsules, Clerc (1903), Gubertet (1916), Baer (1925) all maintaining that capsules were formed. Baer (1925) re-examined Fuhrmann's collection and stated 'ces derniers sont parfaitement visible et ne permettent aucune erreur d'interprétation.' Cohn (1901), Ransom (1909) and Meggitt (1924) thought that infundibulum had a persistent uterus and Meggitt proposed its transfer to the Dilepidinae. For those remaining species with a single crown of hooks and encapsulated ova, Meggitt raised the genus Prochoanotaenia (This is now an accepted synonym for Choanotaenia). Ranson interpreted infundibulum as having a sac-like uterus but with numerous small communicating chambers so that in some cases, eggs appear to be 'isolated in the parenchyma.'

Railliet et Henry (1909) emphasised that if infundibulum and

musculosum belong to the same genus as stated by Fuhrmann then Monopylidium must fall to Choanotaenia because of the latter's priority. The new definition for Choanotaenia - one or more rows of hooks and encapsulated ova, meant that other members of the genus (Fuhrmann's original definition) with a single rostellar row and persistent uteri, were left without a name. They proposed Icterotaenia with T. galbulae Gmelin 1790 as type for those species and independently Lühe (1910) proposed Parachoanotaenia but named no genotype. Fuhrmann (1932)considered this species to have two rows of rostellar hooks and to belong to Anomotaenia. It was necessary yet again to create a genus for the remaining species and he named Paricterotaenia with T. porosa Rudolphi, 1810 as type. It should be pointed out therefore that Icterotaenia Railliet et Henry 1909 is a synonym of Anomotaenia not Paricterotaenia as Fuhrmann himself wrote. However, Joyeux and Baer (1956) have shown that the uterus of galbulae finally breaks down into egg capsules and they have transferred it to the genus Choanotaenia. Yamaguti (1959) has noted this work but retains the species under Anomotaenia.

Fuhrmann's reassessment of the family founders on his use of the structure of the uterus as a bases for the sub-families. This necessitates a knowledge of the precise nature of the uterus which can only be determined when the segments are at their extreme stage of growth - otherwise egg capsules are not observed. No subsequent attempt to re-arrange the family has been successful and Yamaguti (1959) continues to follow Fuhrmann.

Shortly after Fuhrmann's work, López-Neyra (1934)introduced

a new sub-family Monopylidiinae for genera in which the uterus is replaced by 'Parenchymatous capsules.' This is essentially an off-shoot of the Dipylidiinae and to it must be applied the same criticism as to Fuhrmann's sub-families, i.e. that parenchymatous capsules are only evident at maximum growth. Lincicomme (1939) emended Railliet et Henry's family definition to account for minute spines on the acetabulae. This feature seems to be considered of no taxonomic importance by other workers. In 1944, López-Neyra proposed the genus Dichoanotaenia for species of Choanotaenia with two rows of hooks, naming D. citrus (Kr.1869) as type. This genus merely provides a comparable genus to Anomotaenia in the Dipylidiinae and can be ignored. In contrast, two papers published by López-Neyra in 1951 and 1952 are of far-reaching importance. Redescribing P.porosa (Rud.,1810) Fuhrmann 1932, from the Black-headed Gull in Spain, he found egg capsules each containing a single egg. It was necessary to transfer the species to Choanotaenia, a move which left the remaining 43 species devoid of a genus and type. These he suggested should be transferred to other genera. In addition he redescribed microrhyncha, the type of Anomotaenia and again discovered that the uterus breaks down into egg capsules. Further study of the comparative morphology of Paricterotaenia Fuhrmann, 1932, Anomotaenia Cohn, 1900, Choanotaenia Railliet, 1896, Dichoanotaenia López-Neyra 1944, Amoebotaenia Cohn, 1900, Liga Weinland, 1858, Krimi Burt, 1944, Bakererpes Rausch, 1947 and Kowalewskiella Baczynska, 1914, convinced him that all are Dipylidiinae regard-

less of the uterine capsules. At generic level, he emended Choanotaenia and Anomotaenia so that the distinction is a single row of hooks and a double, respectively. Baer (1956) criticized the new arrangement on the grounds that López-Neyra did not study the type material. While acknowledging that the types of all three genera under review have been shown to form egg capsules there are still many species in Paricterotaenia and Anomotaenia which do not - those placed in these genera in the text above, for instance - and if López-Neyra's work is to be accepted then new genera must be created for these remaining species.

Sandeman (1959) has provided a different scheme in which Choanoatenia species are divided between Paricterotaenia (one row of hooks) and Anomotaenia (two rows of hooks). He states that egg capsules are not a sufficient justification for placing the genera as distantly as in two subfamilies. Support for this claim may be found in his remarks concerning the two strains of clavigera (Kr., 1869) to be found under that species in the text above - one strain forming capsules and the other not doing so. In combining the Dilepidinae and the Dipylidiinae, Sandeman has neglected to give priority to the genus Choanotaenia Railliet 1896 over Anomotaenia Cohn, 1900 and it is questionable whether separating the genera on the basis of unilateral or irregularly alternating pores is any improvement. He has followed López-Neyra in re-erecting Monopylidium for those species with parenchymatous egg capsules. His work generally lacks coherence in his failure to nominate genotypes (he does not even list musculosum under Monopylidium!) and the paper contains a notable

contravening of the International Rules for Zoological Nomenclature, in the description of new species without accompanying diagrams. Even more extraordinary is his retention of Paricterotaenia for species with a single row of hooks after López-Neyra's demonstration that porosa (Kr. 1869) forms egg capsules. López-Neyra's suppression of Paricterotaenia to Choanotaenia is more consistent. Surprisingly, Baer and Bona (1960) refer to and apparently follow Sandeman's tentative revision, by transferring Cho. discoidea Joyeux and Baer, 1943, to Anomotaenia and in their emended definition of the genus refer to a uterus which is sacciform or reticulate with no mention of egg capsules!

The formation of 'egg capsules' cannot be dismissed since the different types of development described from various members of Choanotaenia (Fuhrmann's 1932 definition) must have genetic and consequently taxonomic significance. Most important is the account by Bona (1957) for Cho. marchali (Mola, 1907) in which a reticulate uterus breaks down at an early stage into uterine capsules, each with a single egg. While regretting that a thorough study of Cho. infundibulum, the genotype, had not been possible, Bona stated that it was unlikely that marchali belonged to Choanotaenia. He described the development as showing "false parenchymatous capsules" which superficially hardly differed from Cho. musculosa(Monopylidium musculosum) and until it could be demonstrated that musculosum has true parenchymatous capsules, then Monopylidium is a suspect genus. However because of the distinctive structure of the capsules, it may be a valid genus,

even if these capsules are in fact, derived from the uterus like those of marchali.

Another type of development in which a reticulate uterus may or may not break down to surround the onchospheres as a loose uterine envelope has been described by Elce, 1962. While this 'envelope' differs markedly from the accepted uterine capsule, the 'parenchymatous' capsule and the 'false parenchymatous' capsules of marchali, the species larimarina Elce, 1962 can only be placed in Choanotaenia as it is defined by Fuhrmann, 1932.

The helminthologist can expect to find the following combinations of traditionally accepted characters:-

a). Species with a single row of hooks and with a persistent uterus. Previously Paricterotaenia but the type porosa has been shown to break down into egg capsules. Example: P. mariae Mattrick, 1958.

b). Species with a double row of hooks and a persistent uterus. Previously Anomotaenia but microrhyncha has been shown to form egg capsules. Example: A. micracantha (Kr. 1869)

c). Species with a single row of hooks forming uterine egg capsules e.g. Choanotaenia infundibulum (Bloch, 1779).

d). Species with a double row of hooks forming uterine egg capsules. Example: Choanotaenia cirrus (Kr. 1869)

e). Species with a double row of hooks which form 'parenchymatous' egg capsules. Example: Choanotaenia musculosa (Fuhrmann, 1896) (Monopylidium?)

f). Species with a double row of hooks which form 'false

parenchymatous' capsules. Example: Choanotaenia marchali (Mola, 1907) g). Species with a double row of hooks in which a reticulate uterus forms loose 'envelopes' around the eggs which may or may not break down. Examples: Choanotaenia numenii Owen 1946, Choanotaenia larimarina Elce, 1962.

If these characters are still acceptable at a generic level then new genera must be created. While the simplest method is that the taxonomist should ignore uterine development and base generic differentiation on the possession of one or two rows of hooks (vide López-Neyra and Sandeman), this convenient "pigeon-holing" ignores the vitally important fact that one is dealing with living material which is evolving. The writer is convinced that larimarina Elce, 1962 which is quite distinctive with regard to hook size and the smallness of the cirrus pouch as well as the possession of a reticulate uterus, having been found in a species as widespread and thoroughly examined as the Great Black-backed Gull, is one which has evolved recently in West Wales and that it will be recorded in the same or in a modified form further afield in the next few years. (Collections from the same host received from Southampton, Hull and Holland have not yielded this species.) All descriptions refering to a reticulate uterus and demonstrating the presence of egg capsules in former members of Anomotaenia and Paricterotaenia have occured within the last twenty-five years. We are dealing with a phylum which has a massive and rapid reproductive rate in comparison with its warm-blooded hosts but it is only too easy to think of evolution at the host reproduction rate and not that of

the phylum. Many workers stress the necessity of refering to type material and yet the types do not show features subsequently described. This does not necessarily indicate that the original description or material is inaccurate or inadequate. The writer presents two postulates for consideration;

a) in the next few years many more species of Paricterotaenia and Anomotaenia will be found to have evolved egg capsules,

b) we are unlikely, ever again, to find many of the earliest known species in a form corresponding to their original description. One feels this to be particularly true of work up to and including Krabbe (1869) where hook measurements are often the only characters noted.

For these reasons, generic definitions for current and future use which are based on the study of type material rather than by experienced workers on fresh material approximating to the type must be suspect. López-Neyra's recent redescriptions of porosa and microrhyncha illustrates clearly the changes which newer appraisals will yield when related to but not restricted by the genotypes. Meanwhile, until the results of a single worker can be universally accepted, one is obliged to abide by Fuhrmann's clear and concise definitions (1932).

Family: HYMENOLEPIDIDAE Railliet et Henry, 1909

Syn. Hymenolepidinae Fuhrmann, 1909

Sub-Family: Hymenolepidinae Perrier, 1897

Genus: Hymenolepis Weinland, 1858

Syns. Diplacanthus Weinland, 1858

Lepidotrias Weinland, 1858

Dicranotaenia Railliet, 1892

Weinlandia Mayhew, 1925

Wardium Mayhew, 1925

Fuhrmaniella Tseng Shen, 1932

The tri-testiculate Hymenolepids have been divided into numerous genera. The synonyms above are those given by Fuhrmann (1932). Lopez-Néyra (1942) added several genera and Spassky and Spasskaya (1954) and Yamaguti (1959) have divided the known species into a further two score, those of Yamaguti supplementing the former authors. Yamaguti (1959) consequently lists fifty-three genera to which Gonoscolex Saakova, 1958 and Hybridlepis Spassky, 1959 must be added. Some of these newer genera have found acceptance amongst other workers, especially Czaplinski (1956).

By far the most important work on the tri-testiculate group has been published by Deblock, Biguet et Capron (1960) on a revision of the cestodes of Laridae and later by Deblock et Rosé (1962) on those of Charadriiformes. In Section B of the latter paper, they criticise the division of so uniform a genus and state that the relative contraction of the strobila alone is sufficient to cause the specimen to pass from one genus to another. The writers regret that these cestodes defy all rational classification. Johri's

paper (1959) dealing with the variation in testicular pattern and number in H. farciminosa (Goeze, 1782) is disturbing support for Deblock et Rosé since not only are several variations of the tri-testiculate condition recorded but also bi-testiculate and quadri-testiculate specimens. With only a dozen species available in the present collection, the condition of which varies greatly, the writer has chosen to follow Deblock, Biguet et Capron (1960) who recognise two subgenera: Hymenolepis (Hymenolepis) Weinland, 1858, and Hymenolepis (Echinocotyle) Blanchard, 1891. The sub-genus Echinocotyle is retained for those species with spined suckers and a sacculus accessorius. The major reason for favouring this scheme is the remarkable homogenity of the group and the impression from the printed texts, that the multiplicity of characters displayed are those appropriate in separating species not genera. Against this should be noted the possibility that some of the genera acceptable to Czaplinski and others might be considered as sub-genera.

The various synonyms that this schema involves will be listed under the respective species. With respect to Johri's extreme example of testicular variation, when the material was adequate it was found to be reasonably uniform and, it must be admitted, in accordance with the definitions of Lopez-Neyra, the Spasskys and Yamaguti which the writer rejects at a generic level. Particular allowance has been made for the alteration in pattern attendant upon the maturation from the primordia to optimum development, and care has been taken to ensure that when stating the appropriate formulae of Skrjabin and Mathevossian it is the

mature testes which have been examined. The species are considered in alphabetical order.

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19). Hymenolepis (M.) anatina (Krabbe, 1869) N.Comb.

Syns. Taenia anatina Krabbe, 1869

Drepanidotaenia anatina (Kr. 1869) Railliet, 1893

Dilepis anatina (Kr. 1869), Cohn, 1899 (a)

Dicranotaenia anatina (Kr. 1869) Wolffhügel, 1900

Hymenolepis (Drep.) anatina (Kr. 1869) Cohn, 1901

Hymenolepis anatina (Kr. 1869) Fuhrmann, 1926

Echinocotyle anatina (Kr. 1869) Yamaguti, 1959

The species anatina (Kr. 1869) has been recorded in the following Anseriformes throughout the Northern Hemisphere: the Mallard (Anas platyrhynchas L.), the Gadwall (Anas strepera L.) the Tufted Duck (Aythya fuligula (L.)), the Pochard (Aythya ferina (L.)), the Asiatic White-winged Scoter (Melanitta fusca steinegeri Ridgeway), the Shoveler (Spatula clypeata (L.)) the Grey Lag Goose (Anser anser (L.)), the Mute Swan (Cygnus olor (Gmelin)), and the Coot (Fulica atra L.).

The previous British records are from the Partridge (Perdix perdix L.) - Clapham, 1935, and the Domestic duck (Anas platyrhynchas domesticus L.) - Soliman, 1955. The writer recovered specimens from the Mallard (one scolex from a single bird, 12/62) and from the Coot (two scolices from a single bird, 11/62).

External Morphology

Both strobilae from the Coot were immature, 5.5 mm. and 7.3 mm. respectively. That from the Mallard was mature but not gravid, 23 mm. long. This last specimen was very contracted. The scolex is 0.2 - 0.29 mm. in diameter and bears suckers, 0.122 mm. by 0.1 mm. (Figure 71). In the immature Coot specimens, spines

were lacking, but the suckers of the Mallard scolex all had a covering of small, fine spines. The rostellum is extremely long and may extend well into the neck region (0.388 - 0.46 mm.). It is 0.078 - 0.082 wide and has a terminal bulb, 0.123 - 0.13 mm. wide which carries ten large claviform hooks, 0.065 - 0.067 mm. long. (Figure 72). The neck is very long in all specimens, not less than 1.2 mm. and varying between 0.127 mm and 0.159 mm. in diameter. The contracted state of the specimens makes measurements for individual proglottids invalid.

Internal Morphology

a). Musculature

The broken ends of the strobilae showed ten bundles of longitudinal muscles arranged in the cortex. The material was unsuitable for sectioning and no details can be given.

). Excretory system

The dorsal vessel is 0.005 mm. in diameter and the ventral vessel increases in size along the strobila from 0.018 mm. to 0.049 mm. The transverse vessel was not observed.

). Reproductive system

The male genitalia are patent before the onset of segmentation in the material under analysis. That is to say, the heavily stained primordia are visible within the elongated neck region before the external demarcation of the cuticle and cortical regions of the individual segments. The cirrus sac (Figure 73) is ultimately at least 0.232 mm. long 0.024 mm. wide. It contains an internal seminal vesicle, 0.103 mm. by 0.018 mm. and opens into a genital atrium which is in the middle of the left side of the

proglottid. The cirrus was not evaginated and within the sac appeared to lack spines. The testes are in a straight line, one poral, the other two aporal. (Skrjabin and Mathevossian Type 7). They tend to be elongated and narrow but in the more mature segments are spherical and 0.047 mm. in diameter. The external seminal vesicle into which the vas deferens opens, is sac-like, 0.058 mm. by 0.023 mm.

The genital atrium is small, unilateral and receives, ventral to the cirrus opening, the vagina. The sphincter of the latter is 0.005 mm. across and the vagina itself only 0.008 mm. in diameter. It leads back into a large receptaculum seminis, 0.075 mm. by 0.035 mm. A spined sacculus accessorius has been described in this species. Surrounding the vagina and the cirrus pouch as they open into the atrium is a differentiated area which in this material appeared to be glandular. There was no evidence of any structure comparable with the sacculus accessorious of the type found in other tri-testiculate Hymenolepids such as Dicranotaenia. The ovary is lobed and found in the posterior half of the segment. The vitelline gland was not seen. The immature uterus is sac-like and rapidly fills most of the proglottid between the excretory vessels. Ova were not present.

Discussion

Yamaguti (1959) places the species anatina (Kr. 1869) in the genus Echinocotyle Blanchard, 1891. Deblock et al. (1960) define the subgenus Hymenolepis (Echinocotyle) as possessing "spines on the ventral sucker and a sacculus accessorius." In the text above acetabular spines are described on the specimen from the Mallard

but are absent from the Coot material. Czaplinski (1956) has retained anatina in Hymenolepis (Weinland, 1858) (although he recognises Echinocotyle as a genus) and, in particular, with reference to his new species, states "Diorchis (D.) stefanskii sp. nov. scolex differs from the H. anatina scolex in the presence of acetabular spines which wear off easily." The absence of acetabular spines from the Coot material indicates that those of anatina wear off with equal ease. Beverly-Burton (1964) has stated, with reference to Hymenolepis echinocotyle Fuhrmann, 1907, which Yamaguti (1959) has also placed in Echinocotyle, that spinous suckers in immaturity which are subsequently lost cannot be used as the main criterion for transfering Hymenolepis spp. to Echinocotyle. The writer supports this opinion and has retained anatina in Hymenolepis despite the fact that in the present collection it is the immature specimens from the Coot, not the mature strobila from the Mallard which have lost the acetabular spines. The absence of a sacculus accessorius also supports the placing of the specimens to hand as Hymenolepis.

Beverly-Burton (1964) compares 'H. anatina' of Cohn (1901) with Schmidt (1894) and concludes that since Cohn describes only eight bundles in the deep musculature, the writers must be dealing with different species. This can only be determined by a re-examination of Cohn's material but meanwhile these grounds alone are insufficient for considering anatina as an unrecognisable form. The cestode has not been recorded from a wild Anseriform in Britain. The Coot (Fulica atra L.) is a new British host.

Plate 32

Hymenolepis (H.) anatina (Kr., 1869)

Figure 71. Scolex. H.P. X 6.

Figure 72. Hook. Oil.

Figure 73. Cirrus sac. Oil.

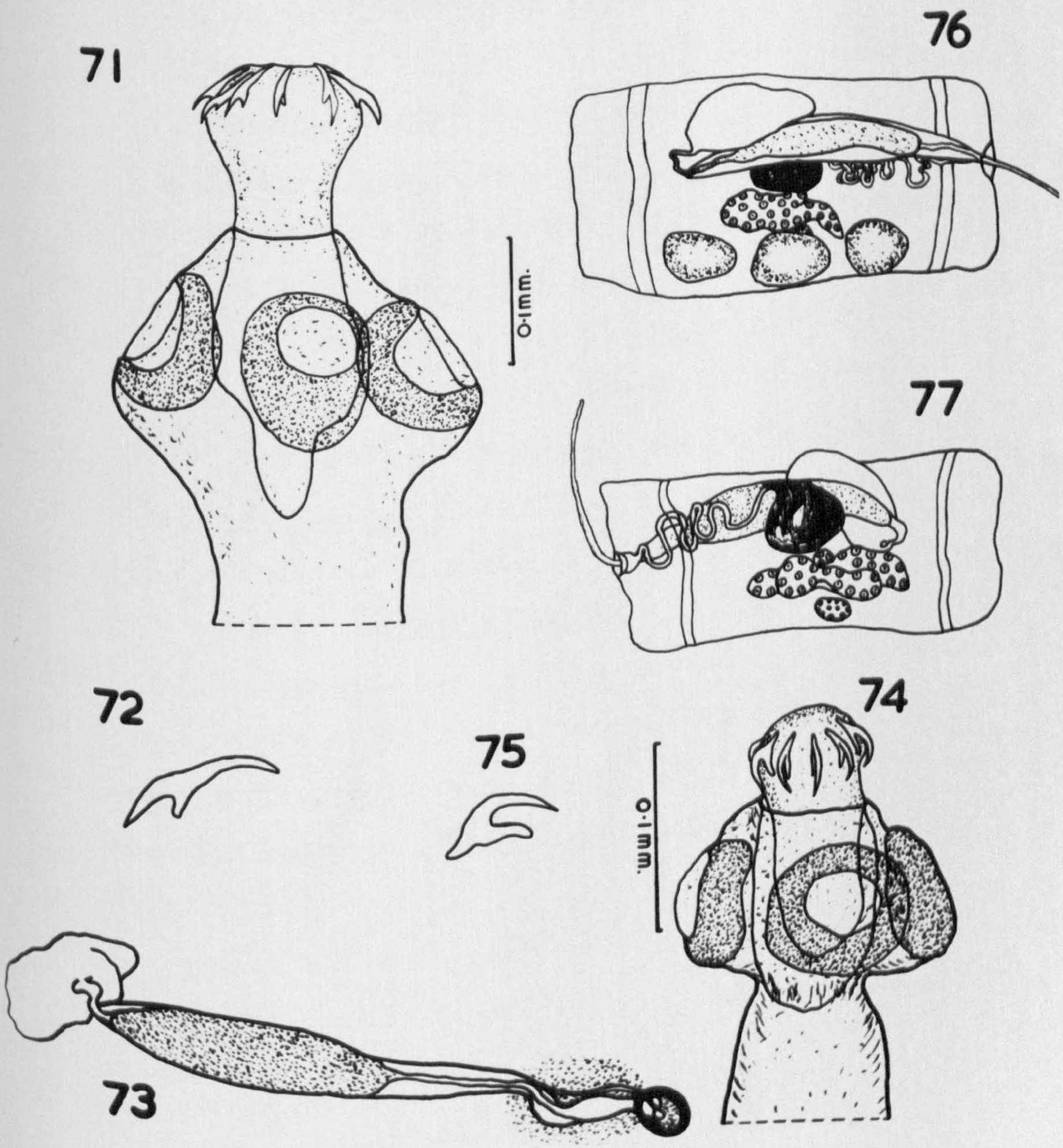
Hymenolepis (H.) cirrosa (Kr., 1869)

Figure 74. Scolex. H.P. X 10.

Figure 75. Hook. Oil.

Figure 76. Early mature segment 'male'. H.P. X 6.

Figure 77. Mature segment 'female'. H.P. X 6. Ventral view.


71
76
0·1mm.
77
72
75
74
0·1mm.
73

20). Hymenolepis (H.) cirrosa (Kr. 1869) Baer, 1956

syn. Taenia cirrosa Krabbe, 1869

Monorchis cirrosa (Kr. 1869) Clerc, 1902

Aploparaksis cirrosa (Kr. 1869) Clerc, 1903

Haploparaxsis cirrosa (Kr. 1869) Mayhew, 1925

Hymenolepis fusus Linton, 1927

Hymenolepis neoartica Davies, 1938

The history and synonymy of this species has been reviewed by Deblock, Capron et Rosé (1960). All the known hosts belong to the Family Laridae: the Common Gull (Larus canus L.), the Blackheaded Gull (Larus ridibundus L.), the Great Black-backed Gull (Larus marinus L.), the Little Tern (Sterna minutus Pallas), the Herring Gull (Larus argentatus Pont.), the Brown-headed Gull (Larus brunneicephalus Jerdon), the Glaucous Gull (Larus hyperboreus Gunnerus), the Caspian Tern (Hydroprogne caspia (Pallas)), and the Common Tern (Sterna hirundo L.). British hosts are the Great Black-backed Gull - Davies, 1938; the Herring Gull- Williams, 1962; the Common Gull - Baylis, 1939, Pemberton, 1963; the Black-headed Gull - Ritchie, 1915, Pemberton, 1963; and the Lesser Black-backed Gull - Pemberton, 1963.

The writer's material was found in a Great Black-backed Gull in Saundersfoot, Pembrokeshire (March 1961). There were three scolices present.

External Morphology

The thin white cestodes are 65 mm. long and 0.52 mm. wide when contracted. When not contracted the width is 0.395 mm. The scolex is small but strong, 0.121 - 0.142 mm. in diameter and bears a

short stubby rostellum only 0.088 - 0.096 mm. long and 0.039 mm. across (Figure 74). The bulb, 0.05 - 0.054 mm. broad, carries ten cheliform hooks in a single row, 0.019 - 0.022 mm. long (Figure 75). The rostellar sac extends beyond the suckers and is 0.072 - 0.088 mm. long and 0.048 - 0.051 mm. diameter. The distinct, strongly muscular suckers are 0.058 - 0.071 mm. diameter. The neck is exceptionally long, at least 2 - 3 mm. and 0.07 - 0.14 mm. wide. An immature segment in which the testes are patent measures 0.055 mm. by 0.17 mm. and a mature segment is 0.16 mm. by 0.395 mm. The most gravid segment was 0.17 mm. by 0.37.

Internal Morphology

a). Musculature

There are two sets of longitudinal fibres, the outer thin layer is continuous, while the inner layer consists of 10 to 12 bundles, 0.008 mm. in diameter.

b). Excretory system

The greatest diameter of the ventral vessel was only 0.021 mm., while the dorsal vessels are only 0.003 mm. The transverse vessel is 0.014 mm. across.

c). Reproductive system

The genital atrium is situated on the right side in the second third of the segment. The testes are found on the posterior dorsal side of each segment where they occupy a straight line. (Skrjabin and Mathevossian Type 6). Initially, the centremost is somewhat posterior to the others, but as the male components develop they congregate at the same level, and are of equal size, (Figure 76). They atrophy when the female genitalia develop. The external

seminal vesicle is at first a small globular sac, 0.042 mm. in diameter, posterior to the end of the cirrus pouch. As it aggregates sperm it increases in size and extends anteriorly, dorsal to the cirrus sac as illustrated in Figure 76. It communicates by a distinct duct to the large cirrus sac, 0.25 mm. by 0.043 mm., which is frequently found to abute upon the aporal vessels. It contains a voluminous internal seminal vesicle 0.1 - 0.16 mm. by 0.019 mm. which in turn opens into a distal glandular area. The cirrus is extremely long, 0.255 mm. by 0.008 mm. and densely covered with fine spines, 0.003 mm. long. In several instances the cirrus had penetrated the atrium of the anterior segment. It has a distinct bulb at the base, 0.012 mm.

There is a marked protandry with only the small vitelline gland ventral to the central testis in the early mature or 'Male' segments. The analuge of the ovary is barely visible at this stage and only develops into a large lobed tripartite organ after the testes have atrophied. It is at most only 0.1 mm. in diameter and occupies the ventral side of the segment but it is dorsal to the vitelline gland. The latter is in the mid-line and is 0.037 mm. at optimum growth. The vagina is exceptionally long and convoluted, 0.004 mm. in diameter but later expanding to 0.014 mm. It opens ventrally to the cirrus sac and runs a parallel course inwards over the excretory vessels and after serpentine coilings, terminates in a large bulbous receptaculum seminis, (Figure 77, shown from the ventral side). This organ is situated ventrally between the vitelline gland and the posterior edge of the cirrus sac. When it is distended by sperm (Figure 77)

it reaches maximum dimensions of 0.068 mm. by 0.065 mm. The uterus commences as a tube shaped like an inverted U which extends backwards on either side of the vitelline gland. It fills with eggs and gradually becomes an irregular sac, filling all the available area. Only the cirrus sac and the receptaculum seminis remain in the gravid segments. Mature ova were not present.

Discussion

Previous writers' measurements are given in Table 26. The most marked difference, obviously affecting all measurements, is the far more relaxed condition of the current material. Thus in a mature segment Davies gives a length to breadth ratio as 1: 6, Deblock et al, as 1: 7, while the writer's ratio is only 1: 2.5. The writer's Figure 76 when compared with Deblock et al's Figure 4 where the poral testis overlaps the excretory vessels and their Figures 4 and 5 both showing the cirrus sac overlapping the aporal vessel, amply demonstrates the relaxed condition of the present collection. A 1: 7 ratio is only evident in material which is contracted longitudinally. A result of this contraction is that in an otherwise splendid paper, the nature of the ovary has been misinterpreted. It is tripartite, with irregular lobes, not trilobed. Davies (1938) is criticised in a footnote (p.63) for describing the ovary as bilobed in excessively contracted material, and these authors commit a similar error.

The slightly smaller hook measurements are compatible with those of Linton (1927) for <u>fusus</u> - an acknowledged synonym. The more spherical nature of the testes and the shorter cirrus sac is

TABLE 26: Hymenolepis (Hym.) cirrosa (Krabbe, 1869)

Characters		Clerc, 1903	Davies, 1939	Deblock et al., 1960	Author
Length of strobila		-	45.0	110.0 - 140.0	65.0
Maximum breadth		1.0	-	1.0	0.520
Scolex	Diameter	0.25	0.14 - 0.17	0.115 - 0.15	0.121 - 0.142
Rostellum	Length	-	0.064	0.050	0.088 - 0.096
	Breadth	-	-	0.025	0.039
	Bulb diameter	-	0.025	-	0.05 - 0.054
Hooks	Number	10	10	10	10
	Size	0.022 - 0.024	0.021 - 0.023	0.022 - 0.023	0.019 - 0.022
Rostellar sac		-	0.117 x 0.058	0.07 x 0.045	0.088 x 0.051
Suckers	Diameter	0.013	0.07	0.05 - 0.06	0.058 - 0.071
Early Segment	Length	-	-	-	0.055
	Breadth	-	-	0.06 - 0.09	0.17
Mature segment	Length	-	0.07	0.07 - 0.08	0.16
	Breadth	-	0.41	0.54 - 0.6	0.395
Gravid segment	Length	-	-	-	0.17
	Breadth	-	-	0.975 - 1.0	0.37
Excretory	Dorsal	0.01	-	0.005	0.003
	Ventral	0.012	0.021	0.04	0.021
Genital atrium			right	right	right
Testes	Number	-	3	3	3
	Size	-	0.053 x 0.04	0.1 x 0.05	0.055 - 0.085
Cirrus sac	Length	-	0.36	0.38	0.25
	Diameter	-	0.023	0.045	0.043
Cirrus	Length	0.42 - 0.43	0.4	0.5 - 0.63	0.255
	Breadth	0.003	0.01	0.008 - 0.011	0.008 - 0.012
External seminal vesicle		-	-	0.009 x 0.08	0.13 x 0.053
Vagina diameter		-	-	0.011 - 0.02	0.002 - 0.004
Receptaculum seminis		-	0.085 x 0.043	0.012 x 0.05	0.068 x 0.065
Ovary		-	0.17	0.225 x 0.065	0.1
Vitellaria		-	-	0.08 x 0.045	0.037
Envelope		-	-	0.038 - 0.05	-
Ova		-	-	0.03 - 0.035	-
Hooks		-	-	0.014 - 0.015	-

accounted for by the more relaxed material on which the writer's results are based and a similar argument holds both for the more rounded receptaculum seminis (0.068 mm. by 0.065 mm. as opposed to 0.12 mm. by 0.04 - 0.05 mm. - Deblock et al.) and the less extensive ovary. The horse-shoe shaped nature of the young uterus in contrast to a laterally extended tube over-reaching the vessels is also due to the excellent condition used for this latest redescription. As A. cirrosa (Kr. 1869) the writer has erroneously claimed a new British host record (Elce, 1962, footnote page 365). This record was of course established by Davies (1938) with his synonymous species Hymenolepis neoartica.

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21). Hymenolepis (H) compressa (Linton, 1892) N. Comb.

syn. Taenia compressa Linton, 1892

Hymenolepis compressa (Linton,1892)Kowalewskii, 1904a

Hymenolepis megarostrellis Solowiow, 1911

Hymenolepis megarostris Gower, 1939

Microsomacanthus compressa Lopez-Neyra, 1942

Hymenolepis paracompressa Czaplinskii, 1956

Linton (1892) described T. compressa from the Canvas-back Duck (Aythya valisneria (Wilson) and the American Black Scoter (Melanitta nigra americana Swainson) at Woodshole, Massachusetts. In Europe the following hosts are recorded: the Mallard (Anas platyrhynchas L.), the Pochard (Aythya ferina (L)), Red Crested Pochard (?) (Aythya rufa (L.)), Garganey Teal (Querquedula querquedula L.), the Scaup duck (Aythya marila (L.)), and the Tufted Duck (Aythya fuligula(L.)).

In the original description Linton recognised three morphological types dependent on length of the strobila: a) 5 - 10 mm., b) 20 - 30 mm., and c) 20 - 30 mm. of exceptional width. Kowalewskii (1907) recognised H. compressa var. minor (6 mm. long) and H. compressa var. major (27 mm. long). These varieties cannot be accepted since length alone is a thoroughly inadequate criterion especially in cestodes where food supply and degree of crowding within the intestine induce great variation.

In Britain the cestode has been recovered from the Scaup Duck - Baylis (1928); the Tufted Duck - Baylis (1939), Beverly-Burton(1964); the Mallard - Beverly-Burton (1964); and the Teal (Anas crecca L.) - Beverly-Burton (1964). The writer's specimens were found in the

small intestine of the Tufted Duck (1 (1) - 1/63) and the Teal (1 (1) - 12/63) from Cresswell Quay on the Cleddau River, Pembrokeshire.

External Morphology

The largest strobila was 14 mm. long and 0.36 mm. wide. At the posterior end of the strobilae a distinct curvature to the left is observed, due to the porul (right) side of each proglottid being larger than the aporal side. The scolex is 0.19 mm. in diameter and bears a rostellum with ten falciform hooks, each 0.056 mm. long (Figure 79). In neither scolex was the rostellum everted, but within the sac it is 0.18 mm. long. The sac is 0.2 mm. long and 0.089 mm. across. The suckers are weak, 0.1 mm. by 0.046 mm. (Figure 78). The neck is 0.13 mm. long and 0.06 mm. diameter. A typical immature segment in which the cirrus pouch is patent is 0.058 mm. in length and 0.165 mm. across. A mature segment is markedly craspedote, and 0.17 mm. by 0.346 mm. while only a single fully gravid segment was available which was longer than broad, 0.275 mm. by 0.21 mm.

Internal Morphology

a). Musculature

There is a continuous outer layer of longitudinal muscles and an inner layer of eight larger bundles, four dorsal and four ventral. There are 2 - 5 fibres thickness in the outer layer while the inner bundles each contain 9 - 12 fibres. Between the inner longitudinal layer and the medulla is a narrow layer of transverse muscles.

Plate 33

Hymenolepis (H.) compressa (Linton, 1927)

Figure 78. Scolex. H.P. X 6.

Figure 79. Hook. Oil.

Figure 80. Cirrus sac. H.P.X 10.

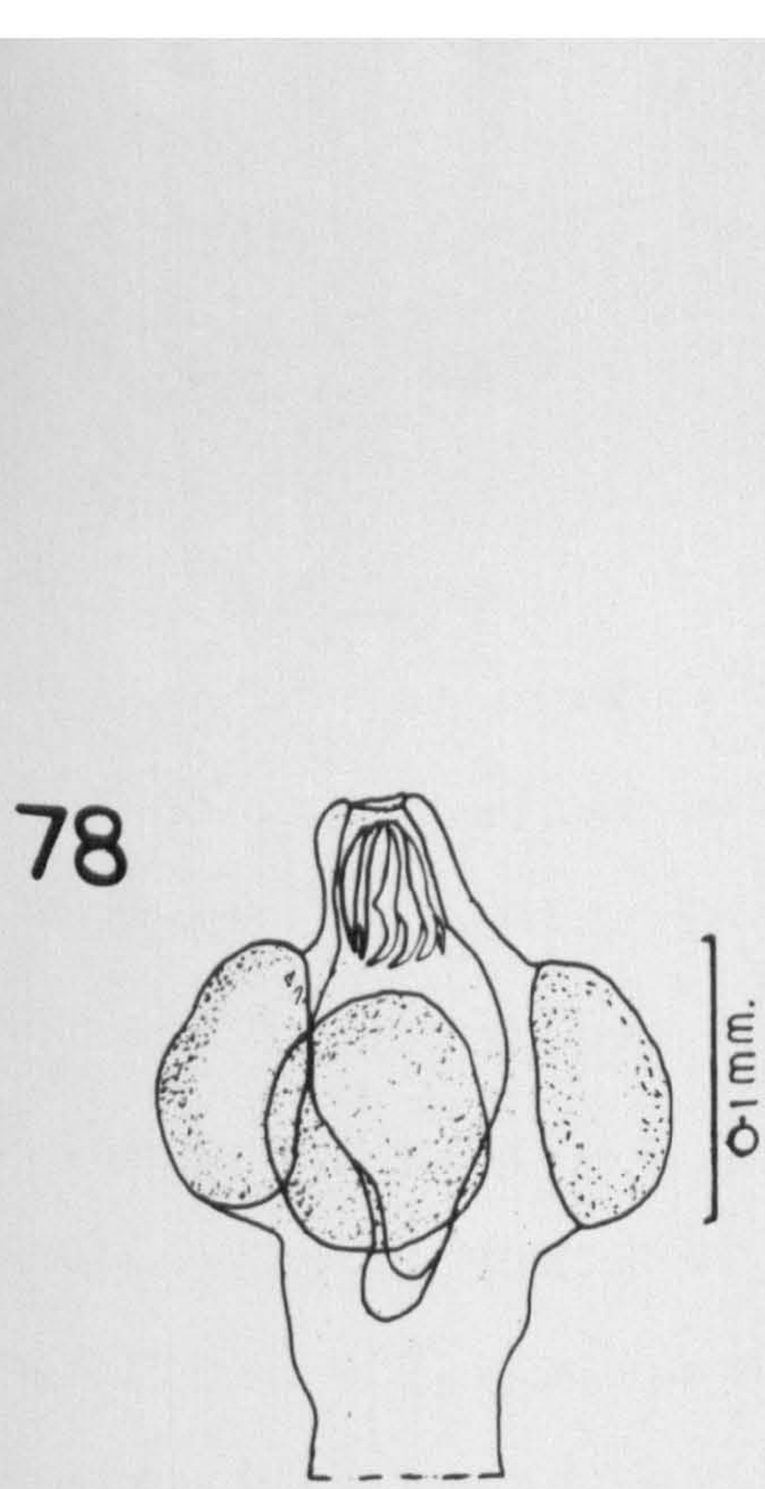
Figure 81. Early mature segment 'male'. H.P. X 6.

Figure 82. Mature segment 'female'. H.P. X 6.

Hymenolepis (H.) farciminosa (Goeze, 1782).

Figure 83. Hook. Oil.

Figure 84. Mature segment. L.P. X 10.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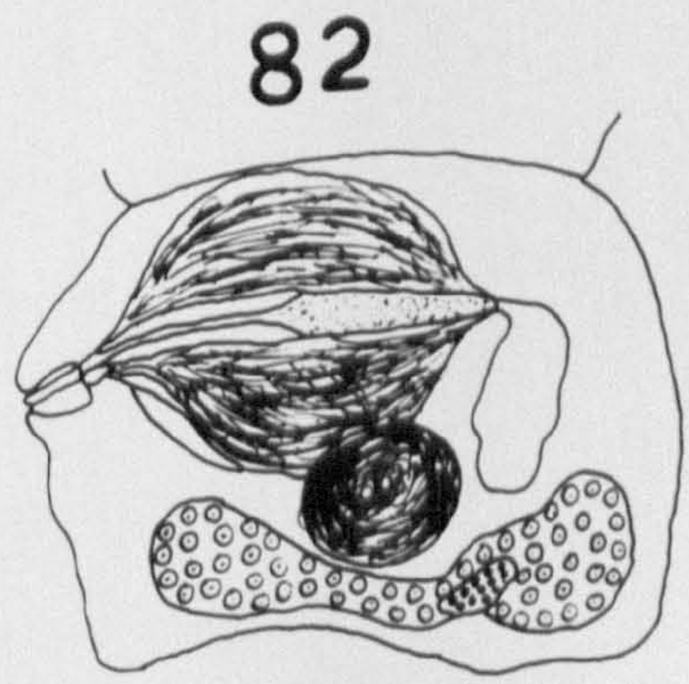
0·1 mm.

80
0·1 mm.

79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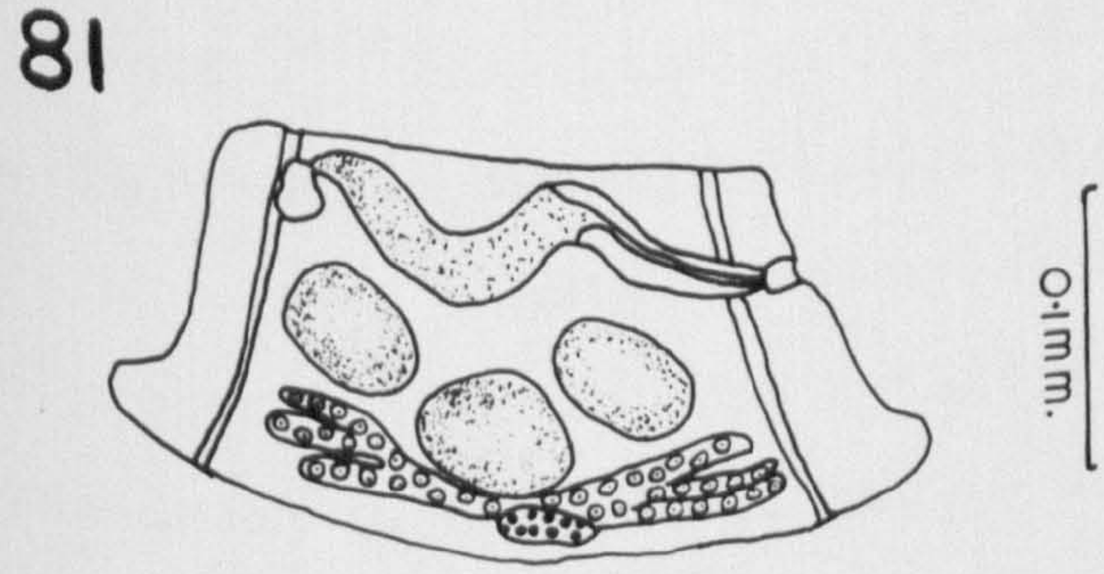
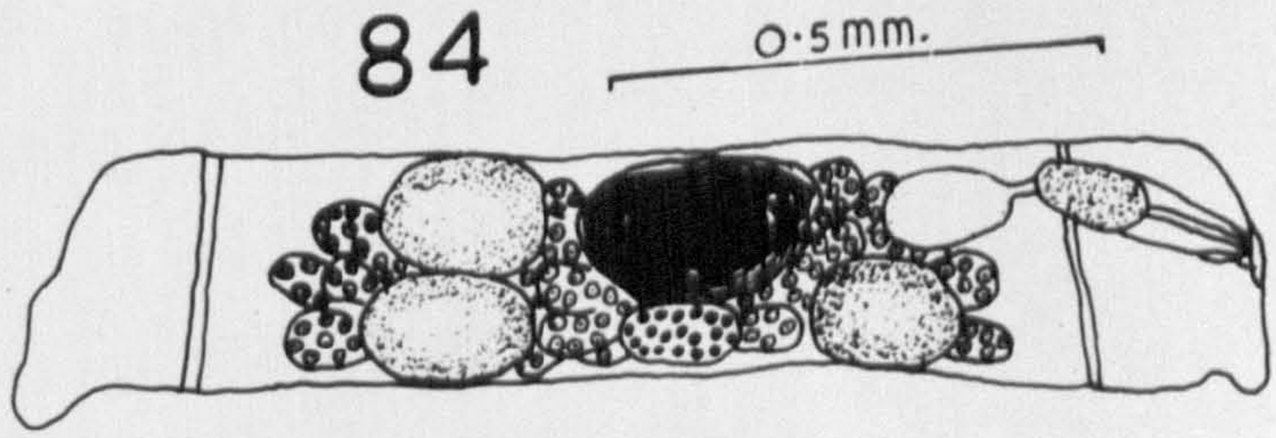

81
0·1 mm.

83


84
0·5 mm.

b). Excretory system

The dorsal vessels are 0.006 mm. and the ventral 0.02 - 0.025 mm. diameter.

c). Reproductive system

The analage of the cirrus sac appears at the 70th. to 75th. segment but those of the testes are not apparent until at least the 85th. segment. The testes are large, rounded, 0.085 mm. in diameter and are at first arranged as an inverted triangle(Figure 81). Ultimately the poral testis is displaced and lies posteriorly alongside the median testis (Skrjabin and Mathevossian Type 5). The vas deferens forms a large spherical external seminal vesicle on the aporal side just posterior to the end of the cirrus sac which it enters by a narrow duct. The cirrus sac is at first elongate and slender, 0. 2 mm. by 0.022 mm. and extends to the aporal excretory vessels. The internal seminal vesicle is 0.18 mm. and leads into a narrow ductus ejaculatorius from which the cirrus is everted. The cirrus consists of an eversible tube from which the cirrus proper emerges. The entire structure is up to 0.07 mm. long and the armed bulb is 0.012 mm. in diameter, (Figure 80). A conspicuous character is that the 'rosethorn' spines are directed forwards. With maturity the muscularity of the cirrus walls increases very greatly, (Figure 82), until an ovoid mass of longitudinal muscles, 0.045 mm. thick enclose the remnants of the seminal vesicle. The cirrus at this stage is the most dominant feature of the proglottid and measures 0.135 mm. by 0.12 mm. No explanation can be offered for this most characteristic feature of the species.

The analage of the ovary is found just posterior to those of the testes and it develops more or less simultaneously into a large slightly lobed organ, 0.11 mm. in diameter, The vitelline gland is 0.03 mm. in diameter. The genital atrium opens half-way along the proglottid on the right lateral margin. It is shallow and receives the cirrus anteriorly and the vagina posteriorly. Both sets of ducts pass dorsal to the excretory cannals and the vagina, 0.082 mm. by 0.014 mm. passes back into a large receptaculum seminis, 0.06 - 0.1 mm. by 0.05 mm. A sac-like uterus fills the entire posterior half of the most gravid proglottid in the collection. The embryonic hooks were not developed.

Discussion

Table 27 gives Linton's measurements together with those of the writer and the two recent redescriptions of Czaplinski (1956) and Beverly-Burton (1964). The only exceptional difference in the accounts is the absence of spines from the conical tip of the cirrus in Linton's original description. The writer's Figure 80 shows quite clearly that these are present.

Czaplinski (1956) created his species paracompressa on the smaller hooks (with a smaller guard) and larger cirrus sac than compressa. Beverly-Burton (1964) has stated that paracompressa is a synonym and the writer is in full agreement. The range of hooks is variable enough to include those of paracompressa and comparison of Figures 81 and 82 will reveal that the difference in the length of the cirrus sac is only the difference between the contraction and relaxation of the longitudinal muscles.

This is the first record of compressa (Linton, 1892) from Wales.

TABLE 27: *Hymenolepis (Hym.) compressa* (Linton, 1892)

Characters		Linton, 1892	Czaplinski, 1956	Beverley-Burton 1964	Author
Length of strobila		5.0 - 27.0	3.6 - 37.6	22.5	14.0
Maximum breadth		-	0.55 - 1.5	-	0.36
Scolex	Diameter	0.18 - 0.24	0.185 - 0.27	0.14 - 0.15	0.19
Rostellum	Length	0.16	0.105	0.15 - 0.2	0.18
	Breadth	0.04	0.035	0.04	-
	Bulb diameter	0.08	-	-	-
Hooks	Number	10	10	10	10
	Size	0.05 - 0.055	0.053 - 0.059	0.056	0.056
Rostellar sac		-	-	-	0.2 x 0.089
Suckers -	Diameter	0.15	0.09 x 0.12	0.14 x 0.112	0.1 x 0.046
Early segment	Length	0.025	-	0.26	0.058
	Breadth	0.14	-	0.38	0.165
Mature segment	Length	-	-	0.28	0.17
	Breadth	-	-	0.6	0.346
Gravid segment	Length	0.37	-	0.3	0.275
	Breadth	0.7	-	0.77	0.21
Excretory	Dorsal	-	0.009	0.005	0.006
	Ventral	-	0.027 - 0.036	0.023	0.02 - 0.025
Genital atrium		right	-	right	right
Testes	Size	-	0.03 - 0.13	0.14 - 0.17	0.085

TABLE 27: *Hymenolepis (Hym.) compressa* (Linton, 1892)

Characters		Linton, 1892	Czaplinski, 1956	Beverley-Burton 1964	Author
Length of strobila		5.0 - 27.0	3.6 - 37.6	22.5	14.0
Maximum breadth		-	0.55 - 1.5	-	0.36
Scolex	Diameter	0.18 - 0.24	0.185 - 0.27	0.14 - 0.15	0.19
Rostellum	Length	0.16	0.105	0.15 - 0.2	0.18
	Breadth	0.04	0.035	0.04	-
	Bulb diameter	0.08	-	-	-
Hooks	Number	10	10	10	10
	Size	0.05 - 0.055	0.053 - 0.059	0.056	0.056
Rostellar sac		-	-	-	0.2 x 0.089
Suckers -	Diameter	0.15	0.09 x 0.12	0.14 x 0.112	0.1 x 0.046
Early segment	Length	0.025	-	0.26	0.058
	Breadth	0.14	-	0.38	0.165
Mature segment	Length	-	-	0.28	0.17
	Breadth	-	-	0.6	0.346
Gravid segment	Length	0.37	-	0.3	0.275
	Breadth	0.7	-	0.77	0.21
Excretory	Dorsal	-	0.009	0.005	0.006
	Ventral	-	0.027 - 0.036	0.023	0.02 - 0.025
Genital atrium		right	-	right	right
Testes	Size	-	0.03 - 0.13	0.14 - 0.17	0.085
Cirrus sac	Length	-	0.235 - 0.44	0.141 - 0.245	0.135 - 0.2
	Diameter	-	0.05 - 0.067	0.027 - 0.1	0.022 - 0.12
Cirrus	Length	-	0.031 - 0.037	0.045	0.07
	Breadth	0.008 - 0.01	0.008 - 0.022	0.007	0.012
External seminal vesicle		-	-	0.039 - 0.056	0.035 - 0.055
Receptaculum seminis		-	-	0.21 x 0.17	0.06 - 0.1
Ovary		-	-	0.19 x 0.38	0.11
Vitellaria		-	0.047 - 0.07	0.09	0.03
Envelope		0.04 x 0.03	0.029 x 0.036	-	-
Ova		0.025	0.019 - 0.022	0.032	-
Hooks		0.01	0.009 - 0.01	-	-

22). Hymenolepis (H.) ductilis (Linton, 1927) Deblock et al, 1960

syn. Taenia microsoma Creplin, 1829

Hymenolepis microsoma (Creplin, 1829) Railliet, 1899a.

Diplacanthus (Dilepis) m. (Creplin, 1829) Cohn, 1899a

Hym. (Drepanidotaenia) m., (Creplin, 1829) Cohn, 1901

Weinlandia m. (Creplin, 1829) Mayhew, 1925

Drepanidotaenia ductilis (Linton, 1927) Lopez-Neyra, 1942

Microsomacanthus ductilis (Linton, 1927), Lopez-Neyra, 1954

Creplin (1829) described Taenia microsoma from the Pochard (Aythya ferina (L).) and Krabbe (1869) recorded the species from the Glaucous Gull (Larus hyperboreus Fabrichii). Subsequent Anseriform hosts include the King Eider (Somateria spectabilis (L.)), the Scaup Duck (Aythya marila (L.)), the Long-tailed Duck (Harelda glacialis (L).), the Velvet Scoter (Melanitta fusca (L.), the Blue Winged Teal (Querquedula discors Stephens), the Eider Duck (Somateria mollissima (L.)).

In 1927, Linton described H. ductilis from the Herring Gull (Larus argentatus Pont.) and the Great Black-backed Gull (Larus marinus L.) in the U.S.A. and differentiated it from microsoma on the basis of the smaller size of the hooks, smaller, less lobed ovary and a more slender cirrus pouch. In addition he described the cirrus as slender and smooth. Baer (1956) described the species from the Glaucous Gull and the Iceland Gull (Larus glaucoides Mayer) in Greenland. He considered that microsoma was a valid species (p. 43) but in 1959 he considered it to be a synonym of ductilis. This was because in 1913 Fuhrmann demonstrated that Krabbe's microsoma included four distinct species, three from

Anseriforms and one from Laridae. Linton's ductilis should be considered valid because microsoma applies to other Anseriform types. Deblock et al. (1960) reviewed Linton's type species and confirmed the accuracy of Baer's observations in that the cirrus is covered by very fine spines. They support Baer's contention that microsoma should be considered a synonym of ductilis but not that lateralis Mayhew 1925 is also a synonym. In Britain it has been recorded from the Velvet Scoter by McIntosh and Nicoll (1927). The writer has found the species in the Eider Duck (3 (1) - 2/63) and the Mallard (Anas platyrhynchas L.) - (2 (1) - 12/62).

External Morphology

The small cestodes rarely exceed 25 mm. and are 0.54 mm. broad. Most specimens are contracted. The scolex is 0.205 - 0.245 mm. diameter and bears four muscular suckers, 0.115 - 0.12 mm. long and 0.075 - 0.108 mm. diameter (Figure 85). The most conspicuous feature is the long thin rostellum, which is at least 0.22 - 0.245 mm. in length and only 0.03 - 0.045 mm. across. The terminal bulb is 0.039 mm. in diameter and bears ten claviform hooks 0.04 - 0.046 mm. long, (Figure 86). The rostellum sac is 0.181 mm. by 0.063 mm.

The neck is fairly short and wide, 0.212 mm. by 0.142 mm. The strobila are generally contracted and it is difficult to give a representative measurement. In an early mature segment the dimensions are length 0.036 mm. and breadth 0.28 mm. and in a gravid 0.065 mm. and 0.532 mm. This relationship is illustrated in Figures 87 and 89.

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Plate 34

Hymenolepis (H.) ductilis (Linton, 1927)

Figure 85. Scolex. H.P. X 6.

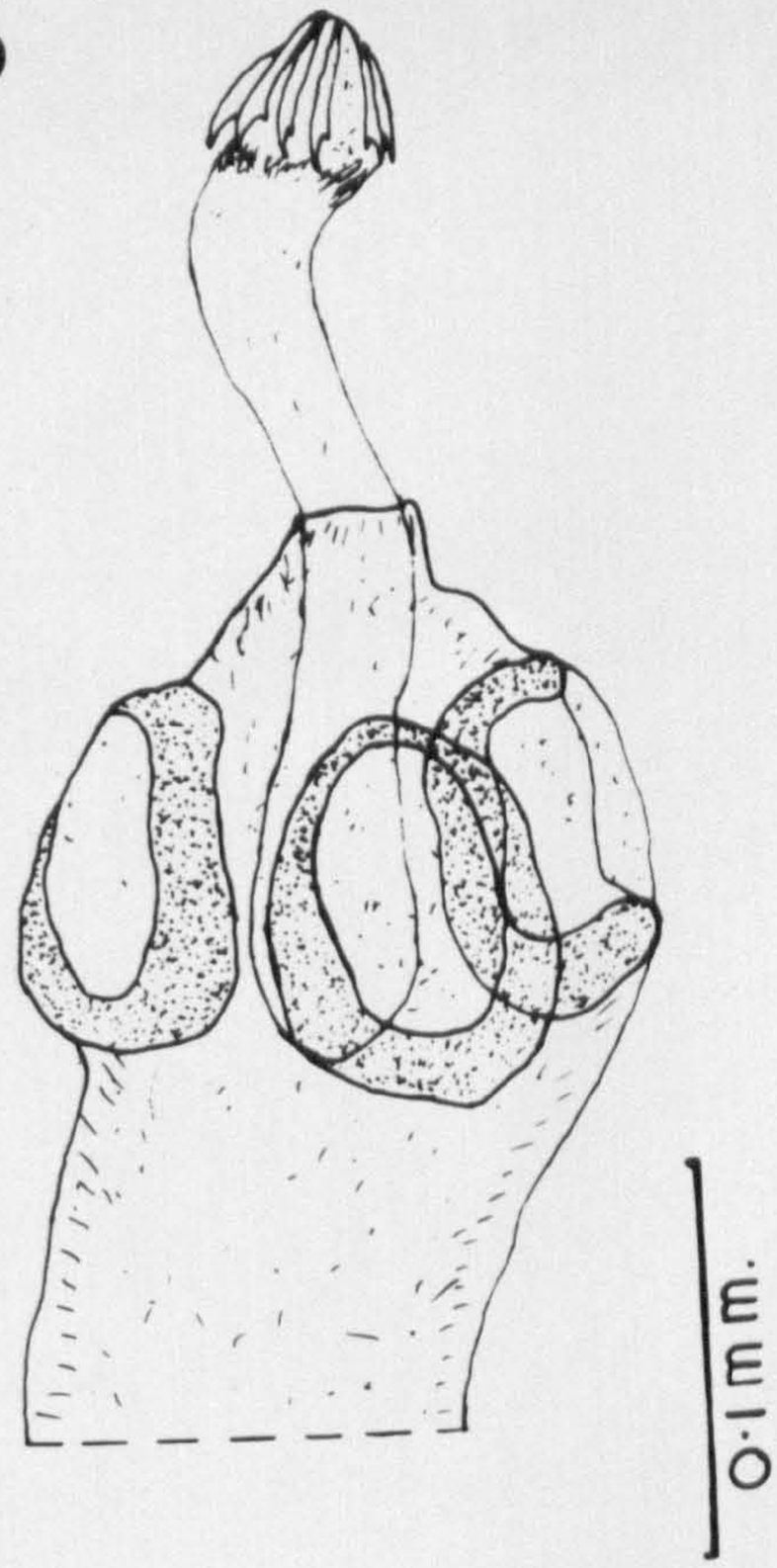
Figure 86. Hook. Oil.

Figure 87. Early mature segment 'male'. H.P. X 6.

Figure 88. Mature segment 'female'. H.P. X 6.

Figure 89. Gravid segment. L.P. X 6.

85



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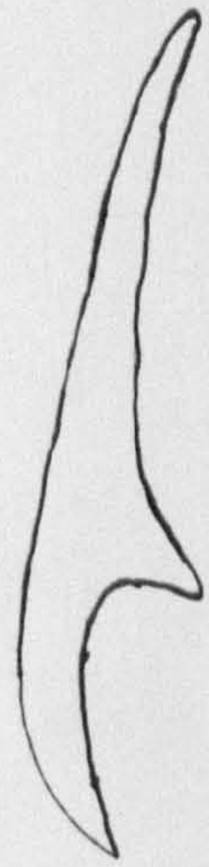

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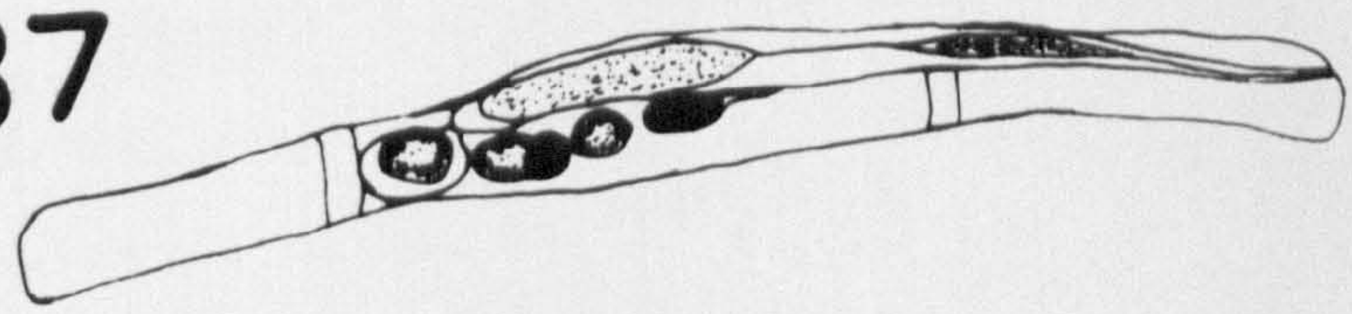

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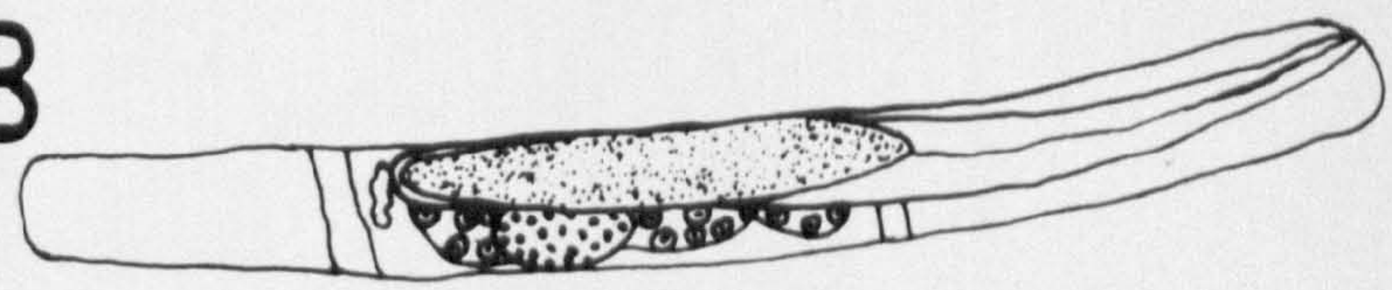

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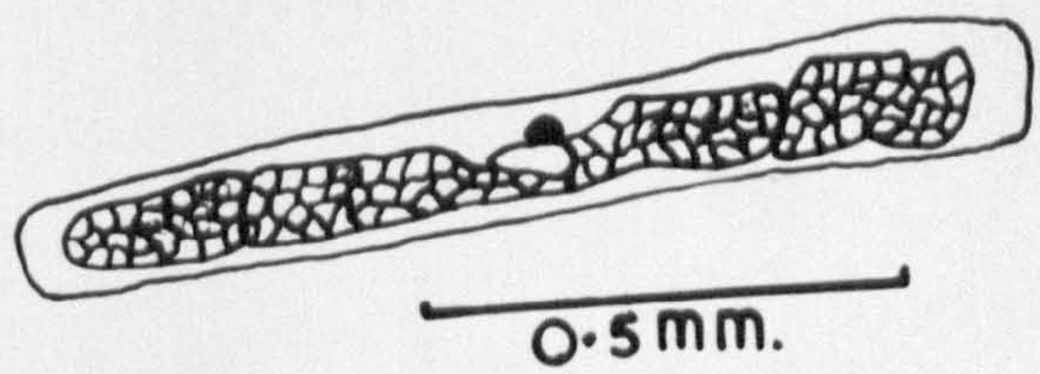

Internal Morphology

a). Musculature

The outer longitudinal layer is 0.008 mm. thick and consists of many bundles. The inner layer comprises eight larger bundles of which four are dorsal and four are ventral.

b). Excretory system

The dorsal vessel has a uniform diameter of 0.005 mm. and the ventral vessel of 0.014 mm. The transverse vessel was not found.

c). Reproductive system

The genital atria are unilateral on the right side and are found in the anterior half of the segment. There is a very marked protandry. Figure 87 is a typical early mature segment in which the testes are seen together with the cirrus pouch, the external seminal vesicle and the ovarian analage. The testes are in a straight line (Skrjabin and Mathevossian Type 8) and increase in size to an optimum, 0.016 mm. in length and 0.042 mm. in diameter. The external seminal vesicle is 0.028 mm. diameter. The cirrus sac extends well beyond the mid-line when mature, 0.198 mm. long (Figure 87). It contains a voluminous internal seminal vesicle, 0.1 mm. long and 0.026 mm. in diameter. The cirrus sac shown in Figure 88, when the ovary is developed, is fully mature with the internal seminal vesicle full of spermatozoa. The armed cirrus was not found everted but within the cirrus sac is 0.1 mm. long.

The vagina opens ventrally to the cirrus and runs to the mid-line where it enlarges to form a receptaculum seminis, 0.065 mm. by 0.029 mm. The lobed ovary appears to develop only after the

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atrophy of the testes and is 0.087 mm. across. The round vitelline gland is small, only 0.024 mm. diameter, (Figure 88). The uterus (Figure 89) is bilobed and sac-like though later it seems to subdivide into loculi. Mature ova were not available.

Discussion

A comparison of the writer's measurements with those of Cohn (1901) reveals that like Cohn the hook length and cirrus sac length are larger than in the standard description. Thus Linton records a cirrus sac length of 0.17 mm. and Baer 0.136 - 0.16 mm., while the writer's material is 0.198 mm. long and Cohn 0.2 - 0.24 mm. As to the hooks, the writer records 0.04 - 0.046 mm. and Cohn 0.045 - 0.05 mm. long, while Baer found only 0.037 - 0.039 mm.

Both the Mallard and the Eider duck are new hosts for Britain. There has been no redescription from material found in this country and the cestode has not previously been recorded from Wales.

23). Hymenolepis (H.) farciminosa (Goeze, 1782). N. Comb.

Syns. Taenia farciminosa Goeze, 1782

T. farciminalis Batsch, 1786

Diplacanthus farciminosa (Goeze, 1782) Volz, 1899

Hymenolepis farciminosa (Goeze, 1782) Railliet, 1899

Weinlandia farciminosa (Goeze, 1782) Mayhew, 1925

Variolepis farciminosa (Goeze, 1782) Spassky et Spasskaya, 1954

This well-known species has been recently described by Mettrick (1958) and Johri (1959). It was first described from the Jay (Garrulus glandarius (L.)) by Goeze, 1782 and its numerous subsequent hosts include the Starling (Sturnus vulgaris L.), the Magpie (Pica pica (L.)), the Indian Crow (Corvus splendens Vieilliot), the Golden Oriole (Oriolus oriolus L.), the Blackbird (Turdus merula L.) and the Missel Thrush (Turdus viscivorus L.). Its life history has been elucidated by Dutt and Mehra (1962).

In Britain the record hosts are: Jay - Baylis (1939), Mettrick (1958); Magpie - Mettrick (1958), Pemberton (1960); Jackdaw (Corvus monedula L.) - Pemberton (1960); and the Starling - Bellingham (1844), and Baylis (1939). The only record from Wales is the Jay (Baylis, 1939) from Radnorshire. The material in the present collection also came from the Jay. There were six specimens in two birds July, 1961 and December, 1962.

External Morphology

The cestodes are long and white, the largest in the present collection measuring 61 mm. with a maximum width of 1.9 mm. The scolex is 0.18 mm. in diameter and the four suckers are 0.078 mm. by 0.089 mm. The rostellum is globular, 0.05 mm. in diameter and

bears ten claviform hooks, each 0.023 mm. long (Figure 83). The neck is 0.42 mm. long and as wide as the scolex in all specimens.

Internal Morphology

a). Musculature

Sections were not made.

b). Excretory system

The excretory system follows the usual pattern. The dorsal vessel is 0.005 mm. and the ventral 0.018 mm. in diameter. The transverse vessel is 0.01 mm. in diameter.

c). Reproductive system

The genital atrium occurs on the left side where it is found as a definite marginal protrusion in the second third of the segment. There is distinct protandry. The testes are patent by the 100th. segment and are arranged with one testis posterior and poral and the other two aporal either obliquely or laterally in tandem (Skrjabin and Mathevossian Type 5). In a typical mature segment 0.142 mm. long and 0.714 mm. wide, the testes are 0.118 mm. in diameter. The poral testis is often rather smaller than the aporal pair. The external seminal vesicle is 0.059 mm. in diameter. It leads into a large cirrus sac 0.165 mm. long and 0.048 mm. in diameter, (Figure 84). The internal seminal vesicle is small. The cirrus, which was not seen everted, is unarmed.

The ovary seems only to reach full maturity after the large receptaculum seminis is at its optimum size, 0.185 mm. and filled with sperm. This large body in the mid-line obscures the external seminal vesicle and most of the other genitalia. The ovary itself is large and lobed, filling much of the ventral side

of the segment. The vitelline gland is quite compact, 0.11 mm. diameter, between the posterior testes and dorsal to the ovary. Such a segment is 0.19 mm. long and 0.96 mm. wide. A gravid segment is typically 0.29 mm. long and 1.4 mm. wide. The ova are 0.025 mm. long and the embryonic hooks 0.008 mm. long

Discussion

Compared with Mettrick's recent redescription (1958) the material collected has smaller cirrus sacs but larger testes. The eggs and the embryonic hook measurements are only half those of Mettrick, but are fully compatible with Johri's account (1959). Johri's paper is principally concerned with the astonishing variation in pattern displayed by the testes. In the present collection Johri's arrangements I a, b, c, and II a are fairly commonplace. In a much contracted segment II b is evident and it is easy to determine how II c might arise. Patterns III to VII were never found and are of dubious value taxonomically for the species but are of the greatest importance when considering the taxonomic structure of the genus.

host - November 1961. One specimen was sectioned and the remainder stained and mounted whole.

External Morphology

The small white worms were found in the small intestine. Those from the Blue and Coal Tits were immature and measured only 2 - 4 mm. The two strobilae from the Great Tit were gravid and were 17 mm. and 21 mm. respectively. All measurements from the former birds are smaller. The largest scolex was 0.33 mm. in diameter, (Figure 90). The rostellae vary between 0.15 - 0.198 mm. long and 0.052 - 0.073 mm. wide. The terminal bulb is 0.082 - 0.088 mm. in diameter and has at its perimeter ten claviform hooks. Those of the Blue and Coal Tits are 0.049 mm. and 0.053 mm. respectively, while those of the Great Tit are 0.055 and 0.057 mm. (Figure 91). The rostellum sac is voluminous 0.35 mm. long and 0.09 mm. wide. The suckers are strongly developed, unarmed, 0.103 - 0.158 mm. by 0.106 - 0.111 mm. Only in the Blue Tit specimen was there any neck, 0.08 mm. long, in all the others the segmentation commenced immediately. A typical immature segment is 0.05 mm. by 0.17 mm., a mature 0.127 mm. by 0.345 mm, and a gravid 0.306 mm. by 1.194 mm., that is nearly three times wider than long.

Internal Morphology

a). Musculature

There are two layers of longitudinal muscles, the outer layer of which is continuous and in a relaxed specimen 0.01mm. thick. The inner layer consists of only three to four fibres per bundle and is only 0.005 mm. thick. A sparse transverse muscle layer lies beneath the inner longitudinal layer.

host - November 1961. One specimen was sectioned and the remainder stained and mounted whole.

External Morphology

The small white worms were found in the small intestine. Those from the Blue and Coal Tits were immature and measured only 2 - 4 mm. The two strobilae from the Great Tit were gravid and were 17 mm. and 21 mm. respectively. All measurements from the former birds are smaller. The largest scolex was 0.33 mm. in diameter, (Figure 90). The rostellae vary between 0.15 - 0.198 mm. long and 0.052 - 0.073 mm. wide. The terminal bulb is 0.082 - 0.088 mm. in diameter and has at its perimeter ten claviform hooks. Those of the Blue and Coal Tits are 0.049 mm. and 0.053 mm. respectively, while those of the Great Tit are 0.055 and 0.057 mm. (Figure 91). The rostellum sac is voluminous 0.35 mm. long and 0.09 mm. wide. The suckers are strongly developed, unarmed, 0.103 - 0.158 mm. by 0.106 - 0.111 mm. Only in the Blue Tit specimen was there any neck, 0.08 mm. long, in all the others the segmentation commenced immediately. A typical immature segment is 0.05 mm. by 0.17 mm., a mature 0.127 mm. by 0.545 mm, and a gravid 0.306 mm. by 1.194 mm., that is nearly three times wider than long.

Internal Morphology

a). Musculature

There are two layers of longitudinal muscles, the outer layer of which is continuous and in a relaxed specimen 0.01mm. thick. The inner layer consists of only three to four fibres per bundle and is only 0.005 mm. thick. A sparse transverse muscle layer lies beneath the inner longitudinal layer.

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Plate 35

Hymenolepis (H.) parina (Fuhrmann, 1907 a)

Figure 90. Scolex. H.P. X 6.

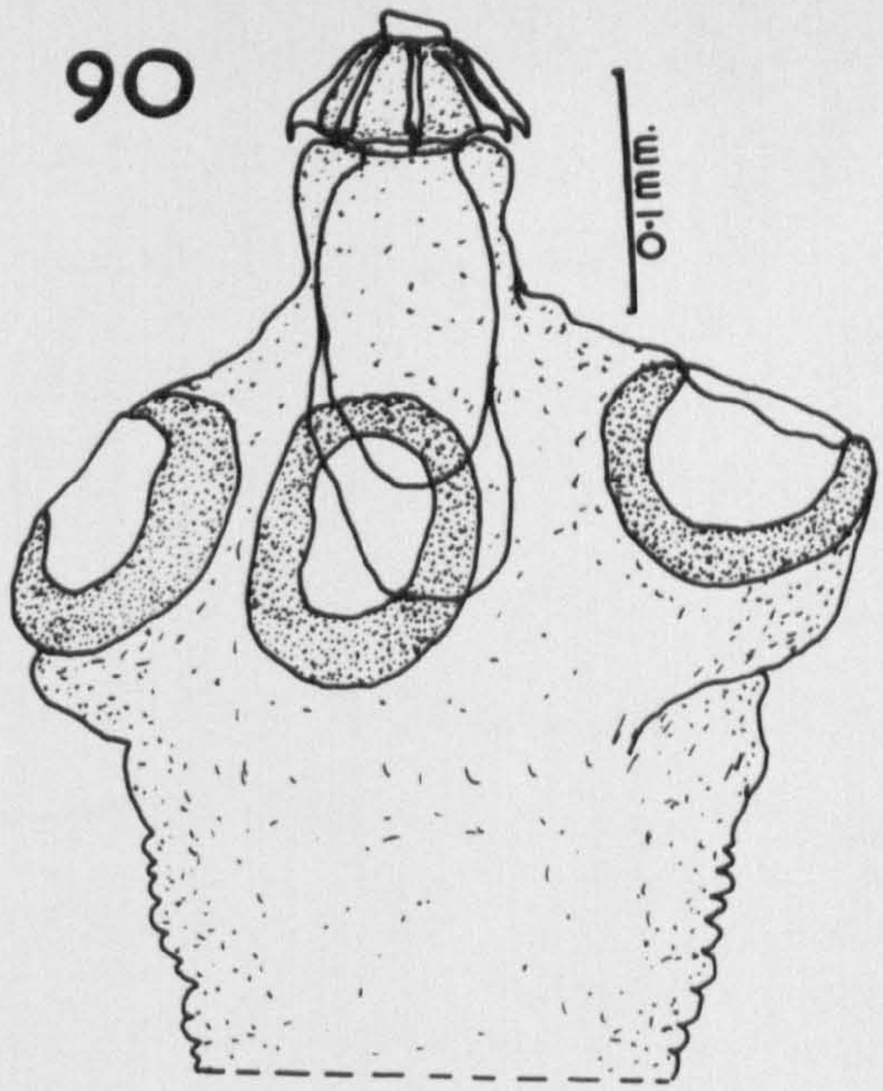
Figure 91. Hook. Oil.

Figure 92. Mature segment. H.P. X 6.

Figure 93. Vagina. H.P. X 10. Ventral view.

Figure 94. Gravid segment. L.P. X 6.

Figure 95. Ovum. Oil.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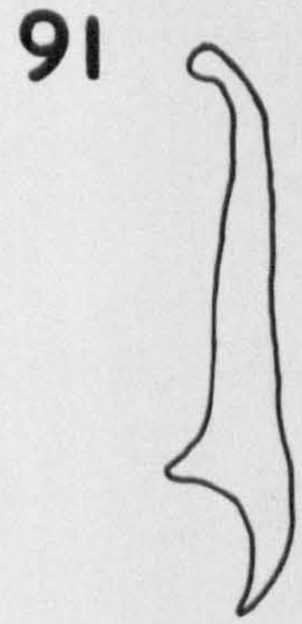
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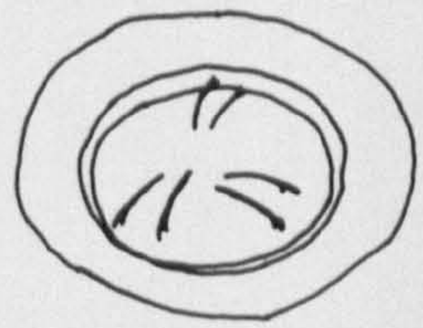
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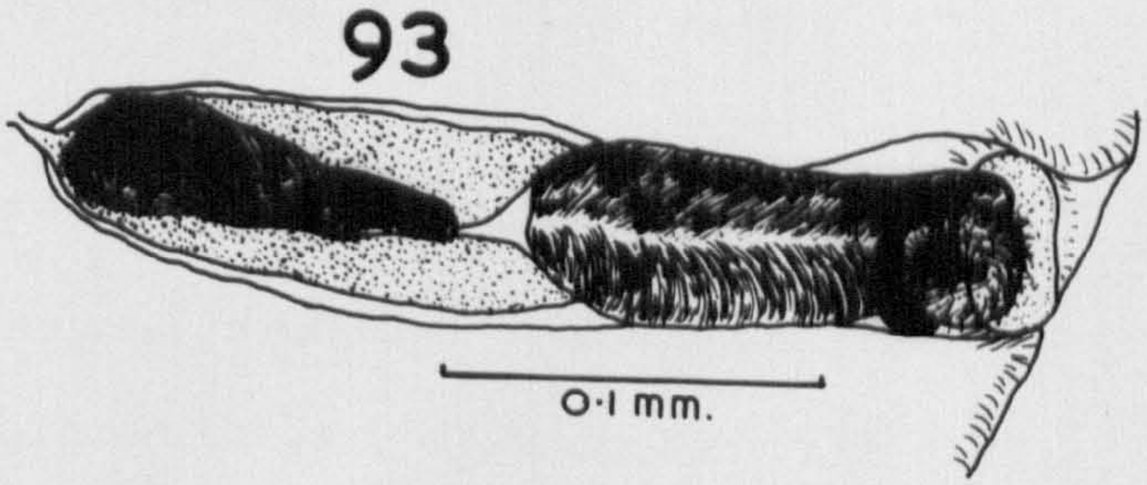
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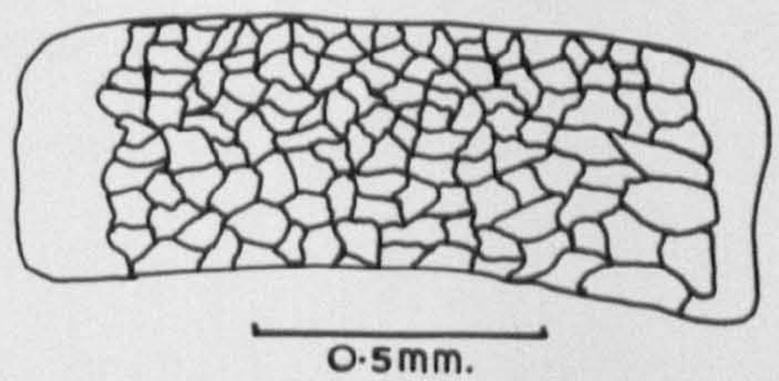
0·1 mm.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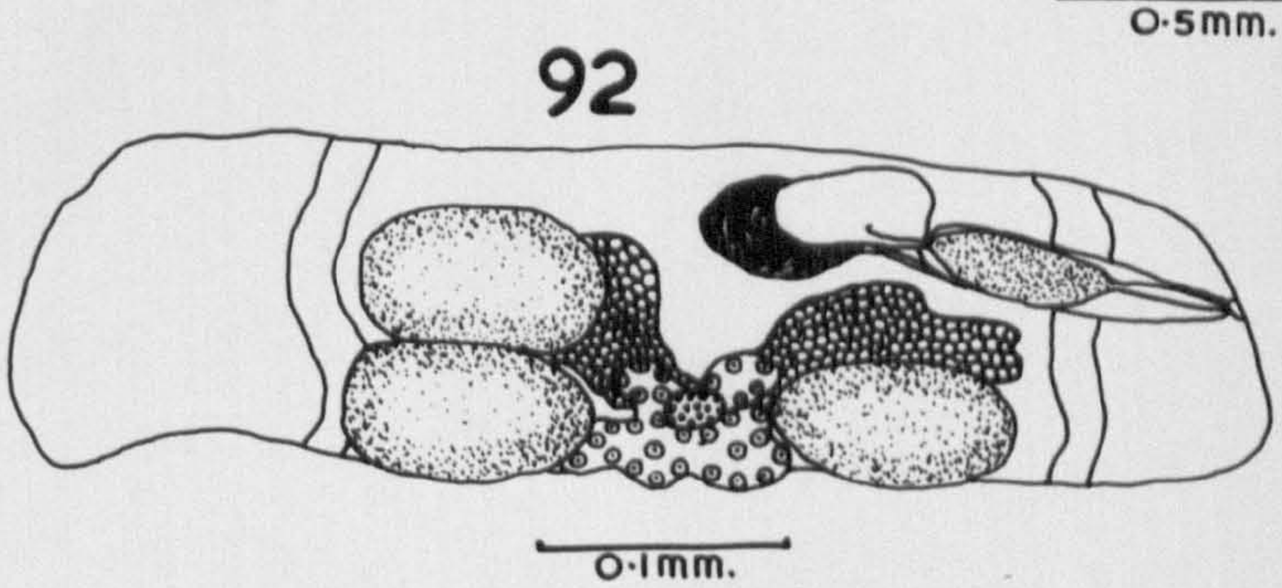
0·5mm.


92
0·1mm.

b). Excretory system

In an immature segment the ventral vessel is 0.013 mm. in diameter but in a gravid it reaches 0.044 mm. Similarly, the dorsal vessel shows a small increase in diameter from 0.005 - 0.008 mm. The transverse vessel is 0.017 mm.

c). Reproductive system

The genital atrium is found unilaterally on the right side in the anterior half of the proglottid. The testes originate in the 60th. segment and are in a triangle with one poral and two aporal (Skrjabin and Mathevossian Type 3). Their maximum diameter in a mature segment is 0.11 mm. by 0.068 mm. (Figure 92). The poral testis is rounded while the aporal pair are flattened where their surfaces touch. At the anterior end of the segment to the right of the midline, the vas deferens expands to form a sac-like external seminal vesicle, which at maturity measures 0.035 mm. long and 0.05 mm. across. It opens by a continuation of the vas deferens into the internal seminal vesicle within the cirrus pouch. The cirrus pouch itself is elongate and varies between 0.112 mm. by 0.03 mm. in an early mature segment ('male') to 0.198 mm. by 0.042 mm. in a gravid. At maximum maturity the internal seminal vesicle is 0.1 mm. long and 0.026 mm. wide, (Figure 92). The cirrus was not found fully evaginated but the strong spination can be seen within the sac to continue for some 0.017 mm. It is 0.026 mm. in diameter and the cirral spines are 0.004 mm. long. The opening into the genital atrium is guarded by a distinct cuticular lip. The atrium is long and deep.

On the ventral side of the atrium immediately below the cirrus is the vaginal opening, 0.014 mm. in diameter, which again has a distinct cuticular and possibly sphincter-like lip. The vagina itself is unique in the present collection of Hymenolepids in being especially developed distally. (Figure 93, drawn from the ventral side, indicates the strong muscular apparatus, which is 0.098 mm. long and 0.029 mm. wide.) Proximally it narrows to a diameter of 0.012 mm. before expanding to form the receptaculum seminis. At maximum development this is rounded measuring 0.07 mm. by 0.04 mm. and it never assumes the dominance shown by the same organ in other species currently redescribed. The ovary is coarsely lobed, ventral and posterior in position, 0.07 mm. long and 0.109 mm. wide. A small dorsal vitelline gland is 0.04 mm. by 0.063 mm. The uterus commences as a pair of lateral lobes ventral to all the other organs. As the uterus matures so it displaces all the other organs and even overlaps the excretory vessels on the dorsal side. Finally it breaks down into numerous loculi each with several eggs, (Figure 94). The onchospheres have at least two coats, the inner one being 0.038 mm. The ovum is 0.032 mm. in diameter and the embryonic hooks are 0.005 mm. long, (Figure 95).

Discussion

Table 28 compares Fuhrmann's original measurements and those of this new material. There has been no redescription and Fuhrmann's original account is brief enough to be quoted in full: "Small cestode, 1 - 2 mm. long and 0.05 mm. broad. The scolex diameter is 0.11 mm. and it carries ten hooks similar to H. fringillarum (Rud.) more or less 0.06 mm. long. In a mature segment,

TABLE 28: Hymenolepis (Hym.) parina (Fuhrmann, 1907)

Characters		Fuhrmann, 1907	Author
Length of strobila		1.0 - 2.0	2.0 - 21.0
Maximum breadth		0.5	1.194
Scolex	Diameter	0.16	0.33
Rostellum	Length	-	0.05 - 0.198
	Breadth	-	0.052 - 0.072
	Bulb diameter	-	0.082 - 0.088
Hooks	Number	10	10
	Size	0.06	0.049 - 0.057
Rostellar sac		-	0.235 x 0.09
Suckers -	Diameter	-	0.103 - 0.158
Early segment	Length	-	0.05
	Breadth	-	0.17
Mature segment	Length	0.34	0.127
	Breadth	-	0.545
Gravid segment	Length	0.44	0.306
	Breadth	-	1.194
Excretory	Dorsal	-	0.005 - 0.008
	Ventral	-	0.013 - 0.044
Genital atrium		-	right
Testes	Size	-	0.056 - 0.11
Cirrus sac	Length	0.1 - 0.16	0.112 - 0.198
	Diameter	-	0.03 - 0.042
Cirrus	Length	0.08	0.07
	Breadth	-	0.026
External seminal vesicle		-	0.05 x 0.035
Vagina		-	0.098 x 0.029
Receptaculum seminis		-	0.07 x 0.056
Ovary		-	0.07 x 0.109
Vitellaria		-	0.04 x 0.063
Envelope		-	0.038
Ova		-	0.032
Hooks		-	0.005

0.34 mm. broad, the cirrus sac is 0.1 mm. long and in a gravid segment 0.44 mm. broad, it is 0.16 mm. long. The cirrus is thickly spined and evaginated; it is 0.08 mm. long. Of the three testes the two antiporal ones lie one behind the other. The female genital organs do not warrant special mention."

Despite the smaller hook measurements of the present work, Figure 89 corresponds exactly with Fuhrmann's Figure 42. The new description is more detailed at all points and in particular the extreme muscularity of the distal end of the vagina and the division of the uterus into loculi are considered by the writer to warrant special mention!

The cestode has not been recorded from the Great Tit in Britain and the Blue Tit (Parus caerulus L.) is a new host. This is the first record from Wales.

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26). Hymenolepis (H.) passeris (Gmelin, 1790) N. Comb.

syn. Taenia passeris Gmelin, 1790

Taenia articum Pallas, 1781 partim.

Taenia arcticus avium Gmelin, 1796

Taenia fringillarum Rudolphi, 1810

Taenia leptodera Linstow, 1879

Aploparaksis fringillarum (Rud.1810) Linstow 1904 b.

Hymnolepis fringillarum (Rud., 1810) Fuhrmann 1926

Passerilepis passeris (Gmelin,1790)Spassky et Spasskaya, 1954

Hughes (1940) showed that the common parasite of Passerine birds H. fringillarum (Rud.1810) is a synonym of H. passeris (Gmelin, 1790). This species has been recorded from the Starling (Sturnus vulgaris L.) and the families Frigillidae, Passeridae and Paridae throughout the world. The British records are: Starling - Baylis (1939), Mettrick (1958); House Sparrow (Passer domesticus L.) - McIntosh and Nicoll (1927); Hedge Sparrow (Prunella modularis (L).) - Mettrick (1958); Chaffinch (Fringilla coelebs L.) - Mettrick(1958); Coal Tit (Parus ater L.) - Mettrick (1958); Blue Tit (Parus caerulus L.) - Evans (1938, unpubl.). The writer has found specimens in the Starling (8 (6) - Winter 61/62), the Chaffinch (3 (1) - 7/61), the House sparrow (2 (1) - 1/60), the Great Tit (Parus major L.) (1 (1) - 11/62), the Marsh Tit (Parus palustris L.)- (1 (1) - 3/62) and the Long-tailed Tit (Aegithalos caudatus L.) - (2 (1) - 11/61). A Starling specimen was sectioned, the rest stained and mounted.

External Morphology

The long white worms are found in the small intestine. The

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External Morphology

The long white worms are found in the small intestine. The

largest specimen measured 43 mm. by 0.98 mm. and was obtained in the Starling while the smallest specimen, from the Marsh Tit, was immature and only 7 mm. long. The scolex is 0.198 - 0.22 mm. in diameter and bears both strongly developed suckers and a rostellum (Figure 96). The suckers are unarmed, 0.09 mm. by 0.078 mm., while the rostellum is 0.102 mm. long and 0.038 mm. wide. The terminal bulb, diameter 0.045 mm. bears ten hooks, 0.023 - 0.027 mm. long (Figure 97). The smaller specimens were from the Tits and the larger from the Starling. As noted by Kintner (1938) the rostellum sac is enormously larger than the rostellum (Figure 96). There is in all specimens a long neck, at least 0.312 mm. and 0.099mm, wide. Kintner (1938) states that segmentation commences immediately behind the scolex. An immature segment with patent cirrus sac and testes, measures 0.07 mm. by 0.184 mm. A mature segment measures 0.225 mm. by 0.658 mm. and a gravid segment 0.23 mm. by 0.938 mm.

Internal Morphology

a). Musculature

There are the usual two layers of longitudinal muscles with both a larger number of bundles and fibres contained in the outer layer. The dorso-ventral muscles are quite well-developed.

b). Excretory system

The dorsal vessels are a uniform 0.006 mm. while the ventral vessels vary from 0.018 mm. in a mature segment to 0.032 mm. in a gravid. The transverse vessel was not visible. All run below the genital duct.

c). Reproductive system

The three testes are patent by the 89th. segment. They

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Plate 36

Hymenolepis (H.) passeris (Gmelin, 1790)

Figure 96. Scolex. H.P. X 10.

Figure 97. Hook. Oil.

Figure 98. Early mature segment. L.P. X 10.

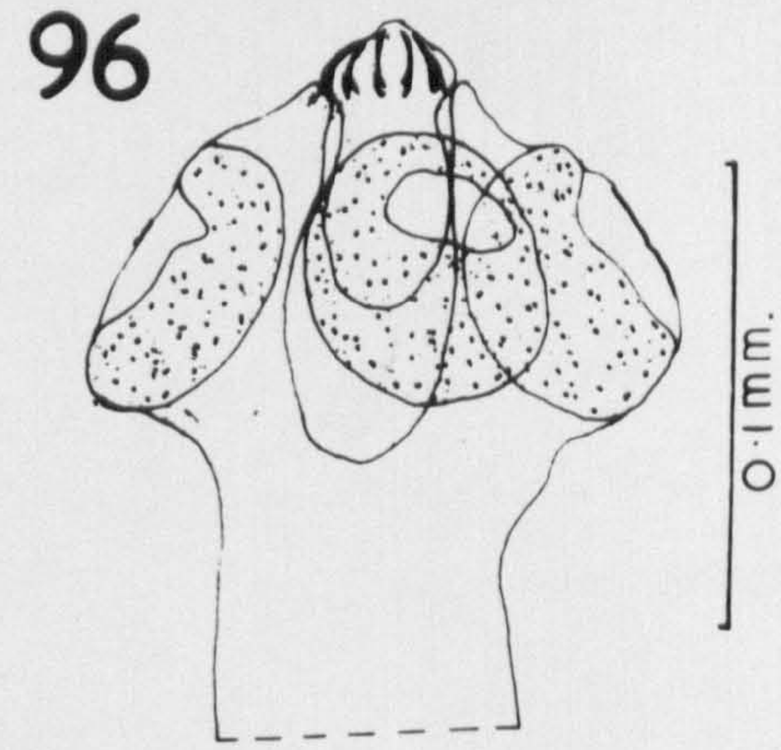
Figure 99. Mature segment. L.P. X 10.

Hymenolepis (H.) rectacantha (Fuhrmann, 1906 b)

Figure 100. Scolex. H.P. X 6.

Figure 101. Hook. Oil.

Figure 102. Early mature segment. H.P. X 6.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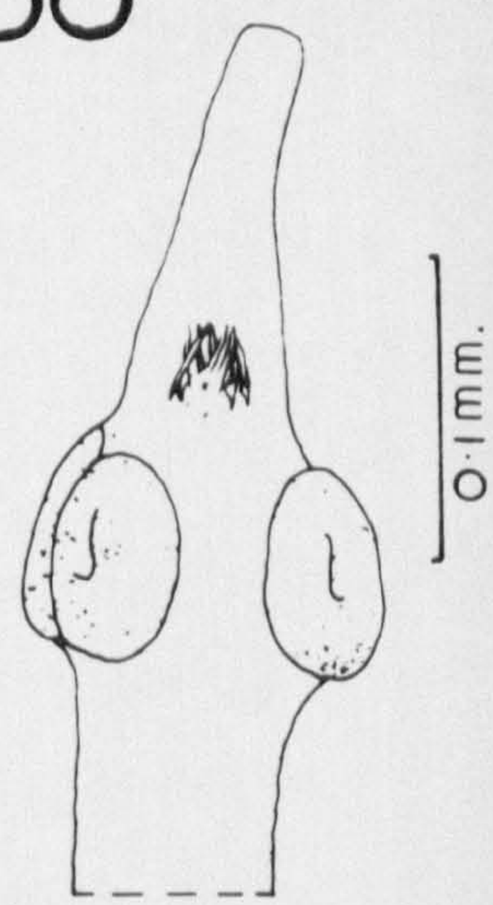
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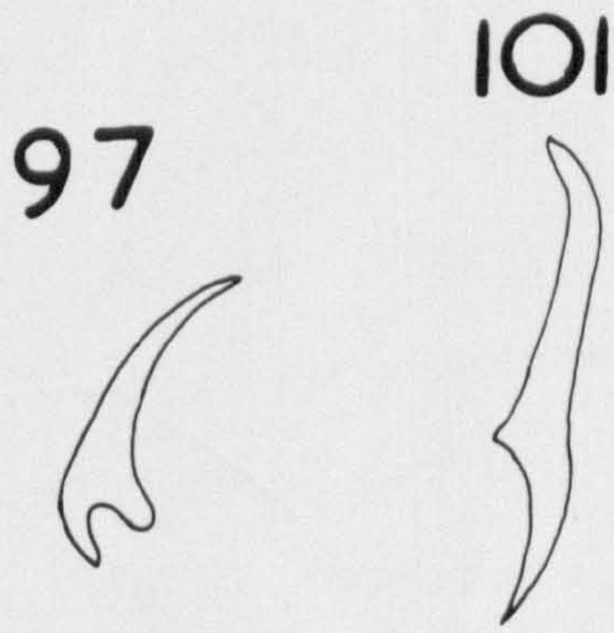
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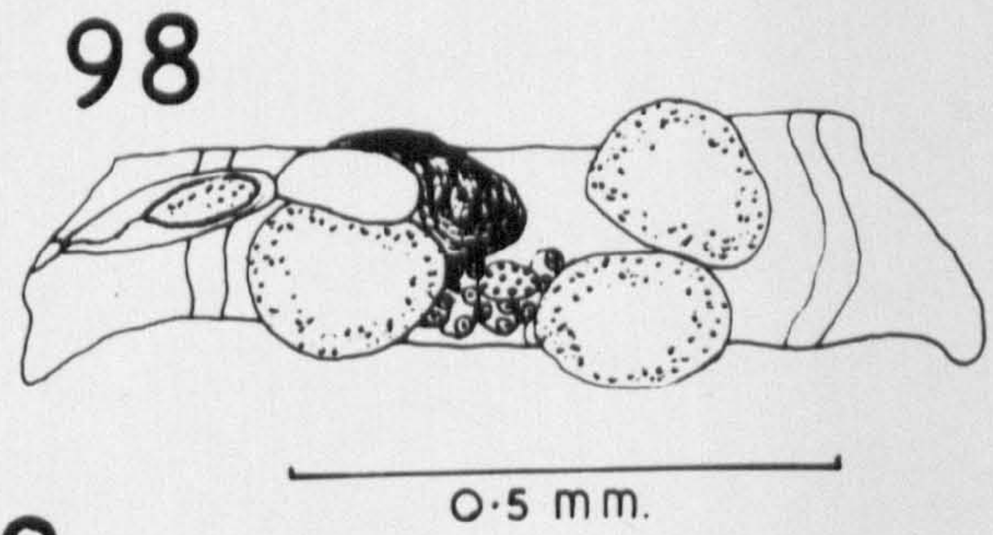
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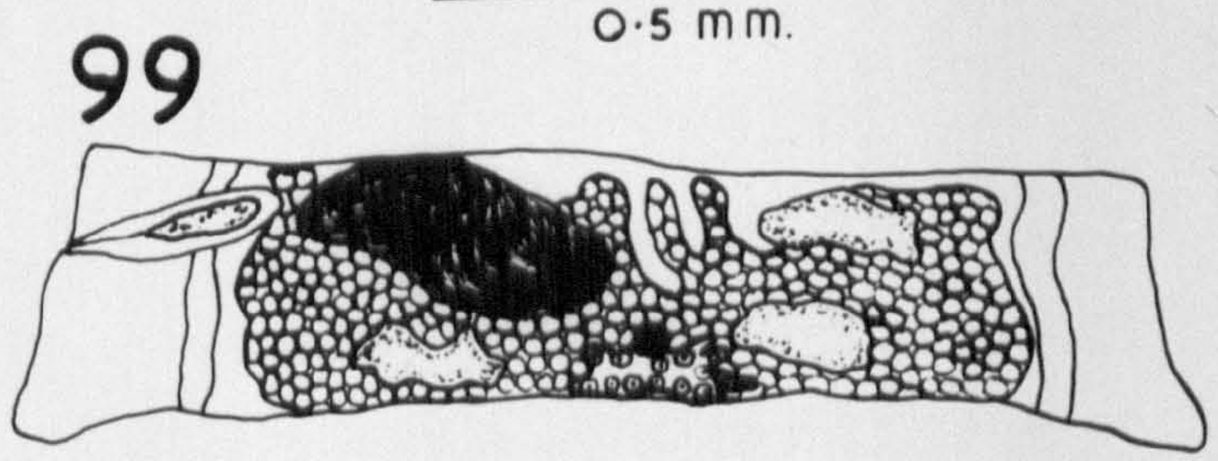
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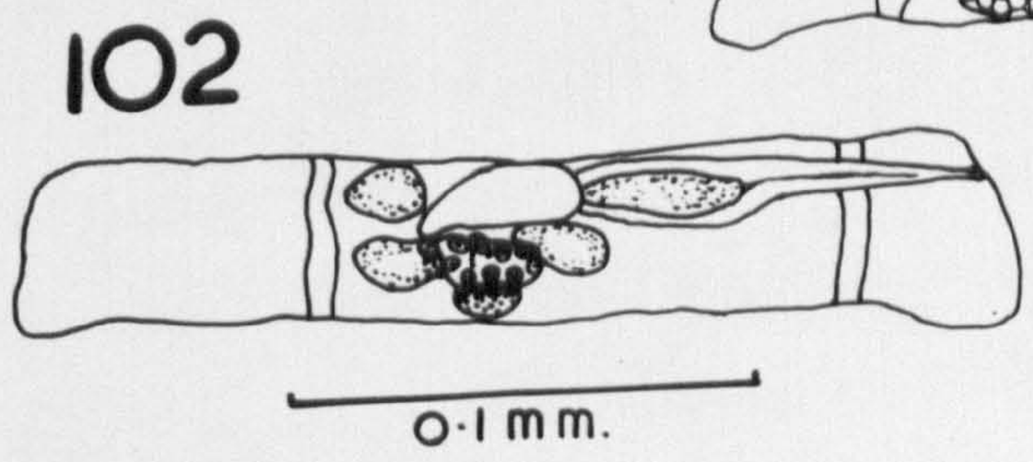
102
0·1 mm.

increase in size until they dominate the mature segment and overlap the adjacent proglottids (Figure 98). The greatest diameter was 0.145 mm. Their arrangement is typical with the poral testis being rounded, until displaced by the enlarged receptaculum seminis and the two aporal being rather flattened on their adjacent surfaces. (Skrjabin and Mathevossian Type 3). The vas efferentia join to form an external seminal vesicle. This tends to be elongated, lying between the anterior mid-line and the proximal end of the cirrus pouch. The maximum dimensions were 0.108 mm. by 0.045 mm. It opens into the rounded cirrus pouch, 0.135 mm. long and 0.027 mm. wide, which contains a well-developed internal seminal vesicle. The cirrus is not everted in the material and appears to be unarmed.

The genital atrium is found unilaterally on the left side in the second third of the segment. It is a shallow funnel, 0.027 mm. deep. Beneath the cirrus pouch is the opening of the vagina, which passes back for 0.13 mm. before expanding as the receptaculum seminis. This large organ, 0.225 mm. by 0.09 mm., lies beneath the external seminal vesicle, which it soon displaces as it increases in size to dominate both the mature and gravid proglottids, (Figure99). The ovary is lobed in the mid-ventral region, though several lobes ramify up to the dorsal side. It is 0.146 mm. across and contains 10 - 14 lobes. Compact vitellaria are found in an antero-dorsal depression of the ovary and are 0.102 mm. long and 0.085 mm. wide. The uterus is sac-like and pairs of lobes ramify between the testes which shrink considerably and eventually the entire medullary region is filled, (Figure 99). The onchospheres measure 0.08 mm. in diameter and the ova 0.04 mm. The embryonic hooks are 0.021 mm. long.

Discussion

The text above is compatible with the two most recent re-descriptions (Table 29). Only Kintner's statement (1938) that the genital atrium occurs on the right side calls for comment since both Mettrick and the writer have material in which it is found to the left. The cestode has not previously been found in Wales and the Great Tit, Marsh Tit and Long-tailed Tits are new British host records.

TABLE 29: Hymenolepis (Hym.) passeris (Gmelin, 1907)

Characters		Kinter, 1938	Mettrick, 1958	Author
Length of strobila		50.0 - 60.0	32.0	43.0
Maximum breadth		-	0.8	0.98
Scolex	Diameter	0.234 - 0.256	0.28 - 0.3	0.198
Rostellum	Length	0.085	-	0.102
	Breadth	-	0.04	0.038
	Bulb diameter	0.053	-	0.045
Hooks	Number	10	10	10
	Size	0.028	0.026 - 0.028	0.023 - 0.027
Rostellar sac		0.228	-	0.21
Suckers : -	Diameter	0.1	0.12 x 0.09	0.09 x 0.078
Early Segment	Length	-	0.09	0.07
	Breadth	0.158	063	0.184
Mature segment	Length	-	0.3	0.225
	Breadth	-	0.65	0.658
Gravid segment	Length	0.41	-	0.23
	Breadth	1.25 - 1.33	-	0.938
Excretory	Ventral	-	-	0.018
Genital atrium		right	left	left
Testes	Size	0.14	0.15 - 0.17	0.145
Cirrus sac	Length	0.172	0.11	0.135
	Diameter	0.064	0.04	0.027
External seminal vesicle		0.17 - 0.07	0.12 x 0.045	0.08 x 0.045
Vagina		-	-	0.13 x 0.013
Receptaculum seminis		0.192 x 0.11	-	0.225 x 0.09
Ovary		-	-	0.146
Vitellaria		0.08	0.1	0.102 x 0.085
Envelope		0.07	-	0.08
Ova		-	-	0.04
Hooks		0.02	-	0.021

27). Hymenolepis (H.) rectacantha (Fuhrmann, 1906 b). Deblock et Rosé, 1962

Syns. Hymenolepis rectacantha Fuhrmann, 1906 b.

Microsomacanthus rectacantha (Fuhrmann, 1906 b) Spassky et Spasskaya, 1954

Fuhrmann (1906 b) described Hymenolepis rectacantha from the Ringed Plover (Charadrius hiaticula L.). He was unable to describe the female genitalia due to the immaturity of the specimen. The species was redescribed with more detail by Davies (1939) who recorded the species from the Oystercatcher Haematopus ostralegus L.). Further British records from this same host are Baylis (1939) and Williams (1962).

The writer found three broken strobilae in an Oystercatcher in March 1961. The specimens were found in the small intestine with a far larger infection of Ophryocotyle insignis Lönnberg, 1890. The paucity of material is evidently due to the latter's dominance in the environment since great care was taken to recover all strobilae.

External Morphology

There were two delicate scolices rather elongate in outline. Their diameter is 0.124 mm. and 0.13 mm. In neither specimen was the rostellum everted and the rostellum sac and its neck-like extension is shown in Figure 100. It measures 0.265 mm. - 0.27 mm. long and the bulbous base which extends beyond the suckers is 0.05 - 0.055 mm. in diameter. The tip of the 'collar' is 0.022 mm. wide. It was not possible to measure the rostellum but the ten claviform hooks are 0.04 mm. and 0.042 mm. long in the respective specimens (Figure 101). The unarmed weakly muscular suckers

measure 0.075 mm. by 0.046 - 0.06 mm. The neck is slender, 0.28 - 0.346 mm. long and 0.072 - 0.08 mm. wide.

Internal Morphology

a). Musculature

No sections were cut.

b). Excretory System

The dorsal vessel is 0.004 mm. in diameter throughout the length of the strobilae but the ventral vessel increases from 0.01 mm. to 0.015 mm. The transverse vessel could not be traced.

c). Reproductive System

The genital atrium opens on the right side and is a shallow funnel with little associated musculature. Because of the indistinct segmentation, it is impossible to state the proglottid in which the genitalia might be considered patent. The testes are small and spherical, 0.014 mm. by 0.018 mm. and are arranged as shown in Figure 102. (Skrjabin and Mathevossian Type 3 with occasional Type 5). In some of the immature segments, their outline is irregular and the anterior testis is obliquely set towards the midline rather than towards the aporal excretory vessel as in Davies (1939) Figure 17. The external seminal vesicle is a sac-like organ, frequently overlapping the proximal end of the cirrus pouch on its dorsal side, in the midline. Its maximum dimensions are 0.168 mm. by 0.028 mm. The cirrus sac is 0.063 mm. long and 0.015 mm. at its widest point. It opens in the anterior half of the segment and contains a small oval internal seminal vesicle, 0.018 mm. by 0.012 mm. which stains deeply. The cirrus was not observed.

The ovary is observed with difficulty as a small spherical body on the ventral side of the segment between the posterior testes which, as the testes atrophy, enlarges in a bilobed gland reaching nearly to the excretory canals on either side. The vitelline gland is an oval body on the dorsal side of the ovary, which increases to maximum dimensions, 0.018 mm. long and 0.025 mm. wide. The vagina opens ventrally to the cirrus pouch and follows a parallel course inwards above the excretory vessels. It is 0.004 mm. in diameter and terminates in a receptaculum seminis, 0.018 mm. long and 0.038 mm. across. This is found towards the posterior end of the segment, overlapping the poral lobe of the ovary. All the genitalia, other than the cirrus pouch, degenerate in the gravid segment. The uterus is sac-like and irregular in outline. The onchosphere is 0.023 mm. and the ovum 0.014 mm. in diameter. The embryonic hook is 0.09 - 0.01 mm. long. A typical gravid segment measures 0.036 mm. by 0.157 mm.

Discussion

Table 30 shows Fuhrmann's original measurements and Davies' redescription (1939) alongside the measurements from this new material. The smaller measurements now presented may be accounted for by the unsatisfactory nature of the material which was not well established in the host. The mature ova have not previously been described, and in particular Fuhrmann's account of the testes arranged in a straight line (Skrjabin and Mathevossian Type 6) is not borne out in this investigation.

Deblock et Rosé (1962) include rectacantha as sp. inq. They point out that having examined Davies' type material for cambrensis

TABLE 30: Hymenolepis (Hym.) rectacantha (Fuhrmann, 1906)

Characters		Fuhrmann, 1906	Davies, 1939	Author
Length of strobila		1 cm	35.0	
Maximum breadth		0.12	0.32	
Scolex	Diameter	-	0.15 - 0.17	0.124 - 0.13
Rostellum	Length	0.2	0.455	-
	Breadth	-	.021	-
	Bulb diameter	0.032	0.032	-
Hooks	Number	10	10	10
	Size	0.045	0.043	0.04 - 0.042
Rostellar sac		-	0.17 x 0.074	0.27 x 0.05
Suckers -	Diameter	-	0.085x 0.075	0.075 x 0.046
Mature segment	Length	-	0.064	0.028
	Breadth	-	0.213	0.164
Gravid segment	Length	0.024	0.055	0.036
	Breadth	-	0.3	0.157
Excretory	Dorsal	-	-	0.004
	Ventral	-	-	0.01 - 0.015
Genital atrium		-	right	right
Testes	Size	0.02	0.021- 0.023	0.014 x 0.018
Cirrus sac	Length	0.08	0.07	0.063
	Diameter	-	0.015	0.015
External seminal vesicle		-	-	0.03 x 0.016
Receptaculum seminis		-	-	0.018 x 0.038
Ovary		-	0.075	-
Vitellaria		-	0.034	0.018 x 0.025
Envelope		-	-	0.023
Ova		-	-	0.014
Hooks		-	-	0.09 - 0.01

they find the hooks to be shorter than in Davies' description, i.e. only 0.046 - 0.051 mm. and never 0.053 mm. These measurements are in the expected range for rectacantha. They conclude that Davies has redescribed rectacantha from specimens of cambrensis. Davies did not describe eggs for either species and those of rectacantha appear above. There are several differences however; cambrensis is described with the testicular pattern Type 6 as in Fuhrmann's original account of rectacantha. Since Davies and the writer describe Type 3 and a tendency to Type 5, there is morphological distinction which is supplemented by the much shorter cirrus sac which does not extend beyond the second testis. In cambrensis it extends beyond all three testes to the poral vessel. Again the guard of the hook is backwardly directed as a continuation of the blade in cambrensis, while Fuhrmann's original figure is approximate to that of Davies and Figure 101 of this text. Fuhrmann was unable to describe the female genitalia and one may conclude that in an immature infection and possibly badly preserved material (as it formed part of another worker's collection), the testes may have been constricted into a straight line. It is submitted that Hymenolepis (H.) rectacantha Fuhrmann, 1906 be considered a valid species.

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28). Hymenolepis (H.) serpentulus (Schrank, 1788.) N. Comb.

syn. Taenia serpentulus Schrank, 1788

Taenia corvi-cornicis (Rudolphi, 1810)

Diplacanthus serpentulus (Schrank, 1788) Volz, 1899

Hymenolepis (Drepanidotaenia) s. (Schrank, 1788) Cohn, 1901

Dicranotaenia s. (Schrank, 1788) Lopez-Néyra, 1942

Mayhewia s. (Schrank, 1788) Yamaguti, 1959

and many others.

This species has been recorded in Passerine birds throughout the world and in Britain, the following hosts are known:- Carrion Crow (Corvus corone L.) Williams, 1962; Baylis, 1939; Mettrick, 1958; Rook (Corvus frugilegus L.) Clapham, 1940; Mettrick, 1958; Williams, 1962: Jackdaw (Corvus monedula L.) Baylis, 1928; Mettrick, 1958: Jay (Garrulus glandarius (L.)) Mettrick, 1958: Magpie (Pica pica (L.)) Davies, 1937., unpubl.; Mettrick, 1958: Fieldfare (Turdus pilaris L.) Mettrick, 1958: Blackbird (Turdus merula L.) Baylis, 1939; Mettrick, 1958: Songthrush (Turdus philomelos clarkii Hartert) Baylis, 1928; Evans, 1938, unpubl.; Baylis, 1938; Mettrick, 1958: Missel Thrush (Turdus viscivorus L.) Evans, 1938 unpubl.; Mettrick, 1958: Ringed Ouzel (Turdus torquatus L.) Baylis, 1939; Starling (Sturnus vulgaris L.) Evans, 1938 unpubl.; Mettrick, 1958.

The writer's material was obtained from the small intestine of the following birds; - the Raven (Corvus corax L.), two strobilae from a single bird, March, 1963; the Carrion Crow, eight strobilae from three birds, April, 1960, August 1960, and March 1963; the Rook provided 13 strobilae from ten birds at all seasons; the

Magpie, eight strobilae from three birds, August, 1962, December, 1962 and January, 1963; the Jay, two from one bird, January, 1963; and the Fieldfare, five from four birds, March, 1963. Some material was sectioned - most was stained and mounted.

External Morphology

The strobilae are long and thin and very white in colour. They show conspicuously through the wall of the intestine. The longest came from the Magpie, 42 mm. long and 1.15 mm. across. The scolices from all the hosts were fairly small and the greatest diameter was only 0.172 mm. (Figure 103). The rostellum is 0.128 mm. long and 0.035 mm. in diameter. The bulb is 0.045 mm. across and bears ten claviform hooks in a single row, 0.022 - 0.025 mm. long. The characteristic shape is seen in Figure 104. There is no indication of the suckers being armed and their diameter is 0.075 mm. by 0.055 mm. The neck is long, at least 0.346 mm. but narrow, 0.088 mm. The first segment in which the genital analagens are visible is 0.07 mm. long and 0.198 mm. across. A typically mature segment is 0.226 mm. long and 0.65 mm. wide. None of the material collected was gravid even though all possible seasonal variations are included.

Internal Morphology

a). Musculature

There are two layers of longitudinal muscles and the outer layer is nearly continuous, with approximately fifty bundles. The inner layer is not so densely muscular.

b). Excretory system.

The dorsal vessel is 0.005 - 0.008 mm. in diameter and the

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Plate 37

Hymenolepis (H.) serpentulus (Schrank, 1788)

Figure 103. Scolex. H.P. X 10.

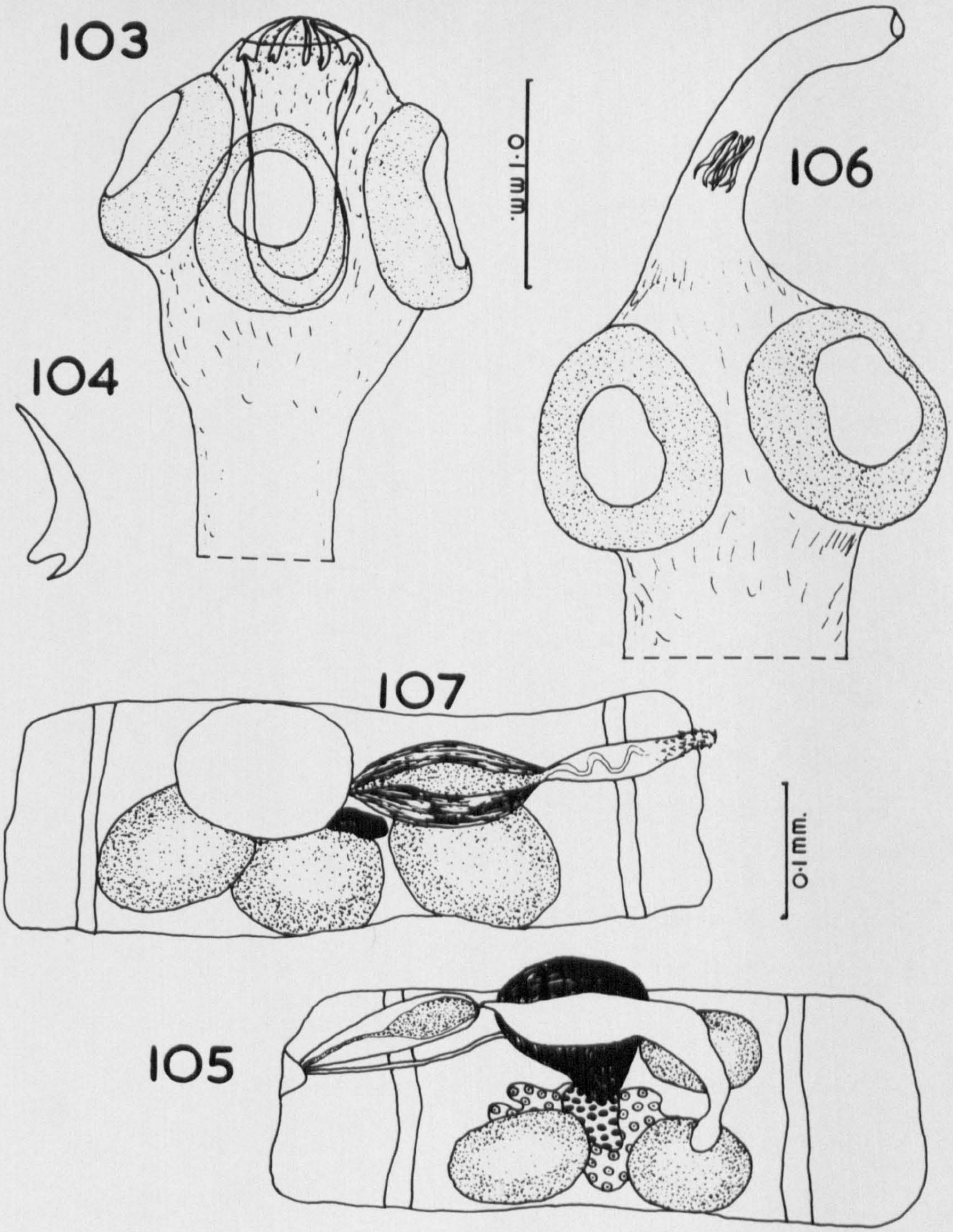
Figure 104. Hook. Oil.

Figure 105. Mature segment. H.P. X 6.

Hymenolepis (H.) solowiow (Skrjabin, 1914 a)

Figure 106. Scolex. H.P. X 10.

Figure 107. Early mature segment. H.P. X 6.


103
104
0·1 mm.
106
107
0·1 mm.
105

ventral vessel varies from 0.018 to 0.022 mm. On the poral side both are ventral to the genital ducts. The transverse vessel varies between 0.009 mm. and 0.012 mm.

c). Reproductive system

The cirrus pouch is patent by the 85th. segment and some twenty segments further the testes are fully formed. The poral testis is posterior and the aporal testes are either in tandem or set slightly obliquely with the anterior testes inclined rather more toward the midline. (Skrjabin et Mathevossian Type 3). The mature testis is at least 0.145 mm. in diameter. As the segment matures so the external seminal vesicle tends to envelop and obscure the two aporal testes as seen from the dorsal side. This becomes elongated and sac-like, eventually opening into a rather short rounded cirrus sac. The genital atrium is found in the anterior half on the left side of the strobila and from it the cirrus sac passes back anteriorly above the excretory canals. At maturity it is 0.142 mm. long and 0.05 mm. in diameter. It extends halfway to the midline, (Figure 105).

The genital atrium is rather shallow, 0.035 mm. by 0.03 mm. and receives the vagina postero-ventrally. It is 0.016 mm. wide and extends for at least 0.165 mm. before widening to form the receptaculum seminis. This again dominates the mature segment, reaching at least 0.17 mm. diameter. Between the two posterior testes in the midline is the pear-shaped, compact vitelline gland which is 0.075 mm. across. It is found dorsally to the ovary which is not easily visible and does not take the stain well. The uterus is essentially sac-like and ramifies between the other

organs. It is found mainly on the ventral side. Mature ova were not found.

Discussion

Early redescriptions of note were given by Volz (1899) and Cohn (1901). Furhmann (1908) listed host records. Those up to 1940 have been listed by Hughes. Markowskii (1933) described the musculature. The life history was attempted by von Linstow (1893) and in 1945, Jones separated two subspecies from the Starling and the Robin on the basis of morphology (the material from the Robin was consistently smaller) and of cytology. The present account shows no significant departure from more recent redescriptions.

The Raven is a new British host record while the Fieldfare and Jay are new Welsh records.

29. Hymenolepis (H.) solowiow (Skrjabin, 1914) N. Comb.

Syns. Hymenolepis fausti Tseng Shen, 1932

Nadjedolepis solowiow Yamaguti, 1959

H. solowiow was imperfectly described by Skrjabin (1914) from the Pochard (Aythya ferina (L) and the Pintail (Anas acuta L.). He bases his species on the characteristic cirrus sac which becomes increasingly muscular in the manner of H. compressa (Linton, 1927) - vide Figure 80. This species has remained somewhat obscure morphologically until Beverly-Burton (1964) published her redescription with details of the rostellar hooks. Her material was obtained in the Pintail from Suffolk and a Tufted Duck from St. James Park, London. The writer found fragmented strobilae and scolices in the posterior region of the small intestine of a Tufted Duck (Aythya fuligula (L.)). These fragments were stained with the greatest care.

External Morphology

There was no complete strobila so the maximum length cannot be given. The maximum width is 0.52 mm. The scolex is 0.165 - 0.175 mm. wide and has four weak unarmed suckers, 0.089 mm. in diameter. Neither rostellum was everted in the two scolices obtained and dimensions cannot be stated. The rostellum sac extends as a "collar" for 0.135 mm. (Figure 106). There are ten falciform hooks, 0.026 - 0.028 mm. long. The neck is 0.063 mm. long and 0.103 mm. wide. A segment in which the male elements are mature measures 0.099 mm. long and 0.318 mm. wide. A segment in which the uterus is developed and the cirrus sac completely spherical is typically 0.207 mm. long and 0.506 mm. wide.

Internal Morphology

a). Musculature

Sectioning was impossible.

b). Excretory system

The dorsal vessel is 0.006 mm. in diameter and the ventral vessel 0.015 mm.

c). Reproductive system

The genital atrium is on the right in the anterior half of the segment. The three testes are at first in an inverted triangle with the middle testis forming the apex. As the cirrus sac increases in size so the poral testis is pushed posteriorly and finally the aporal testis is displaced by the enlarging external seminal vesicle (Figure 107). The testes is therefore in a straight line when mature (Skrjabin and Mathevossian Type 6). The testes are 0.07 - 0.077 mm. in diameter. The external seminal vesicle is median or slightly aporal, 0.079 mm. across and leads to the cirrus sac. When relaxed it is 0.198 mm. long and 0.059 mm. wide, extending to the midline. The muscular walls are 0.015 mm. thick. As the segment matures the cirrus sac becomes spherical 0.115 mm. by 0.135 mm. with walls 0.05 mm. thick. The cirrus is strongly spined but not fully everted. In none of the segments has it been possible to differentiate the female glands, while in the gravid fragments the ova were not mature.

Discussion

Until Beverly-Burton's work was published some months ago, the specimens were tentatively identified as H. fausti Tseng Shen, 1932, (from the Mallard (Anas platyrhynchos L.) in China). The

hooks are identical in size but in the description the relaxed cirrus sac is larger (0.285 mm. by 0.068 mm.) and the testes are also larger (0.148 - 0.171 mm.) (These measurements are taken from Czaplinski, 1956). The testes arrangement is an inverted triangle approximately Skrjabin et Mathevossian Type 2. Czaplinski synonymised this species with paracompressa Gasowska, 1931, but Beverly-Burton and the present writer find this unacceptable since the hook measurements for paracompressa are 0.037 - 0.043 mm. Beverly-Burton stresses the differences in testicular arrangement and in her material describes the testes as lying "in straight rows across the segment even when first visible." This last statement is not true of the writer's specimens in which the initial triangular arrangement may persist until the cirrus sac is fully mature. The larger cirrus sac may be accounted for by the complete relaxation of the organ, prior to the shortening and increase in muscularity which Tseng Shen has described. In view of these statements, there is no valid reason why fausti should not be thought a synonym of solowiow as described by Beverly-Burton and the present writer.

The Tufted Duck is confirmed as a host for the species and this is the first occasion that the worm is recorded in Wales.

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30). Hymenolepis (H.) stylosa (Rudolphi, 1810) N. Comb.

Syns. Taenia stylosa Rudolphi, 1810

Diplacanthus stylosa (Rudolphi, 1810) Volz, 1899

Hymenolepis stylosa (Rud.,1810) Railliet, 1899

H. (Drepanidotaenia) stylosa(Rud.,1810) Clerc, 1903

Weinlandia stylosa (Rud. 1810) Mayhew, 1925

Passerilepis stylosa (Rud.,1810),Spassky et Spasskaya, 1954

Hymenolepis stylosa has been recovered extensively from Passerine birds throughout both hemispheres. It was redescribed by Volz (1899), Clerc (1903) and many others, the most recent of whom is Mettrick (1958). Bellingham recorded the species in the Magpie (Pica pica (L).) in Britain in 1844, and the same host is recorded by Mettrick (1958). The Jay (Garrulus glandarius (L.)) is a host according to Davies, 1937 unpubl., Baylis, 1939 and Mettrick, 1958; the Rook (Corvus frugilegus L.), the Carrion Crow (Corvus corone L.) and the Jackdaw (Corvus monedula L.) are further hosts - Mettrick (1958). The writer has found the species frequently in the Jackdaw - nine strobilae from five birds shot in August, 1960, March, 1963, August, 1963, December, 1963 and January, 1964; the Magpie - nine specimens from two birds, December, 1962 and January, 1963; and the Starling (Sturnus vulgaris L.) - six scolices from five birds during the Winter of 1962/63. Less frequently, two strobilae were recovered from a Jay, January, 1963; two from a Coal Tit (Parus ater britannicus Sharpe and Dresser) in August, 1962; two from a Marsh Tit (Parus palustris L.)

in March, 1962, and one from a Long-tailed Tit (Aegithalus caudatus L.) in November, 1961. A specimen from the Magpie was sectioned and representatives from each host were stained and mounted.

External Morphology

None of the cestodes exceeded 40 mm. in length and from the Tits the material was less than 20 mm. long. The maximum width was 0.56 mm. The scolex is 0.235 - 0.27 mm. in diameter and the four suckers which were unarmed but fairly muscular are 0.108 mm. by 0.095 mm. (Figure 108). In contrast the rostellum is rather weak and was not everted in any specimen. It is 0.11 mm. long and the bulb, 0.04 mm. diameter, bears ten claviform hooks, 0.03 - 0.033 mm. long, (Figure 109). The neck is 0.215 mm. long and 0.14 mm. wide. A typical immature segment is 0.113 mm. long and 0.17 mm. wide, while a mature segment was 0.17 mm. long and 0.428 mm. wide. No fully gravid segment was available.

Internal Morphology

a). Musculature

The usual two layers of muscles are present, with the outer layer composed of up to sixty bundles and the inner with fewer, only eight to ten. A fairly thick transverse layer separates both the longitudinal layers from the medulla.

b). Excretory system

The dorsal vessel is a uniform 0.005 - 0.007 mm. in diameter for its entire length while the ventral vessel varies from 0.17 mm. to 0.038 mm. as the strobila matures. The transverse vessels are approximately 0.01 mm. across.

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Plate 38

Hymenolepis (H.) stylosa (Rud., 1810)

Figure 108. Scolex. H.P. X 6.

Figure 109. Hook. Oil.

Figure 110. Mature segment. H.P. X 6.

Diorchis acuminata (Clerc, 1902)

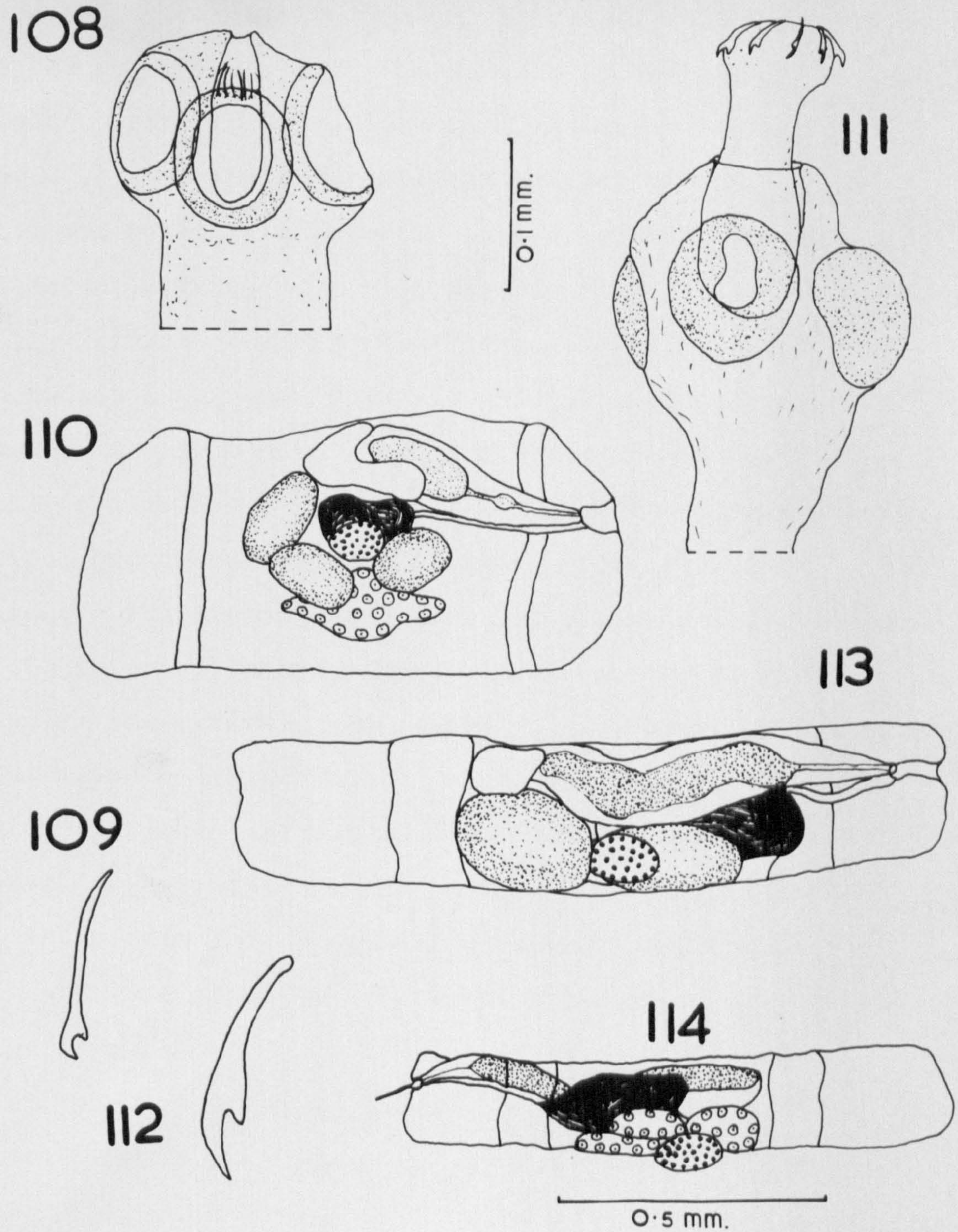
Figure 111. Scolex. H.P. X 6.

Figure 112. Hook. Oil.

Figure 113. Early mature segment 'male'. H.P. X 6.

Figure 114. Mature segment 'female'. L.P. X 10.

Ventral view.


108
111
0·1 mm.
110
113
109
114
112
0·5 mm.

c). Reproductive system

The testes are in a triangle with the two aporal slightly oblique to each other (Figure 110). In an early mature segment the cirrus sac is 0.14 mm. long and reaches to the mid-line. It contains posteriorly an internal seminal vesicle which measures 0.05 mm. by 0.015 mm. and anteriorly an unarmed cirrus. The external seminal vesicle is anterior to the foremost testis and the receptaculum seminis. This latter organ is in the mid-line and partially obscures the vitelline gland, 0.065 mm. by 0.06 mm. The vagina, which leads back from the genital atrium is 0.12 mm. long and 0.009 mm. in diameter. The ovary is found ventrally to all the other organs and is fairly small and lobed in the mid-line, As the various organs mature so they reach their respective maximum sizes. The cirrus pouch tends to become rounded and pear-shaped as the internal seminal vesicle fills and no longer reaches the mid-line. The external seminal vesicle becomes increasingly sac-like, diameter 0.095 mm. and together with the receptaculum seminis, diameter 0.147 mm. dominates the more mature proglottid. The uterus arises ventrally and gradually fills the proglottid except for the cirrus sac, receptaculum seminis and atrophied testes, all of which persist. The unilateral atria are to the right of the strobila.

Discussion

This text agrees with the standard descriptions for the species. A comparison with Mettrick's recent account (1958) shows consistently smaller measurements throughout the present material. The Coal Tit, Marsh Tit and Long-tailed Tits are new host records. The cestode

has not previously been found in Jackdaws and Starlings from the Welsh areas.

Sub-family Hymenolepidinae

Genus: Diorchis Clerc, 1903

In 1902 Clerc described Drepanidotaenia acuminata from the Coot (Fulica atra L.) and various Anseriformes - the Teal (Anas crecca L.), the Wigeon (Anas penelope L.) and the Gadwall (Anas strepera L.). It had ten hooks and two testes. In the following year he used this species as the basis of his new genus Diorchis in which all species with the above characters and with the inner longitudinal muscles divided into four ventral and four dorsal bundles were placed. Unlike many Hymenolepid genera this definition has persisted and the genus has never been synonymised.

31). Diorchis acuminata (Clerc, 1902) Clerc, 1903

Syns. Drepanidotaenia acuminate Clerc, 1902

Diorchis ransomi Schultz, 1940

Clerc's original description is rather generalised and in particular the hook measurements given (0.027 - 0.039 mm.) has been thought by subsequent authors to include several species. Ransom (1909) described some material from the American Coot (Fulica atra americana Gmelin) which was used by Schultz (1940) to establish the species Diorchis ransomi. It is much regretted that Clerc failed to state whether species from different hosts had consistent hook measurements for that host. Czaplinski (1956) has emphasised the inadequacy of Creplin's description and considers that ransomi Schultz 1940 might by a synonym. A further host is the Lesser Scaup (Aythya affinis Eyton). This author accepts Czaplinski's suggested synonym, and Beverly-Burton's(1964) record of D. ransomi from the Tufted Duck (Aythya fuligula (L.)) must be

accounted the first British record.

The species described below were obtained in a Coot in January 1962 from the Cleddau Estuary.

External Morphology

None of the five strobilae were gravid. The maximum length was 40 mm. and the breadth 0.75 mm. The scolex is 0.196 - 0.211 mm. across (Figure 111) and bears a well-developed rostellum, 0.21 mm. long and 0.046 mm. in diameter. The terminal bulb is 0.069 mm. wide and has ten claviform hooks, 0.034 mm. long (Figure 112). The suckers are not very muscular and are fringed with tiny spines. The neck is narrow, 0.08 mm. in diameter but is very elongated with no segmentation evident for at least 0.6 mm. An immature segment with the primordia of the cirrus sac and testes showing is 0.04 mm. by 0.27 mm. and an early mature segment in which the testes are in their prime is 0.098 mm. by 0.27 mm. Fully mature segments with developed ovaries and distended receptacula semini measure 0.142 mm. long and 0.728 mm. diameter.

Internal Morphology

a). Musculature

An outer, cortical layer of longitudinal muscles consists of numerous small bundles each with 4 - 6 fibres. There are in addition eight bundles in the inner layer of which four are dorsal and four are ventral. The number of fibres here varies between twelve and twenty.

b). Excretory system

The dorsal vessels are 0.012 mm. in diameter and remain constant in dimensions until they degenerate in the late mature strobila.

The ventral vessels are up to 0.085 mm. wide in the mature segment and the transverse vessels, 0.018 mm. wide.

c). Reproductive system

The genital atrium is to the right in each segment and opens marginally in the second third. It is funnel-shaped, 0.009 mm. wide and 0.026 mm. deep. There is a very marked protanary. In a segment in which the male components are mature, there are two testes (Figure 113). They lie on either side of the mid-line on the postero-dorsal side of the segment. That which is aporal is rounded, 0.095 mm. by 0.09 mm. while the poral testis tends to be flattened by the presence of the cirrus sac and is 0.108 mm. by 0.048 mm. At this stage the external seminal vesicle is 0.033 mm. by 0.018 mm. and opens into a cirrus sac, 0.28 mm. long. Three quarters of its length is occupied by an internal seminal vesicle. The cirrus is 0.072 mm. long and is 'whip-like' with a spined basal bulb, 0.012 mm. across. As the testes degenerate so the external seminal vesicle fills out and attains a size of 0.185 mm. It is situated dorsally over the aporal end of the cirrus sac. The cirrus sac lengthens to 0.49 mm. and touches the aporal excretory vessel. At this stage it is full of spermatozoa.

Meanwhile the ovary has developed into a tri-lobed organ at the ventral and posterior side of the segment. Its total diameter is 0.285 mm., each lobe is 0.056 mm by 0.109 mm. Dorsally, between the posterior lobes is the compact oval vitelline gland (Figure 114). The vagina is posterior to the cirrus sac and is slightly cuticularised. It extends backwards and then distends to form an enormous receptaculum seminis beneath the cirrus sac.

TABLE 31: Diorchis acuminate (Clerc, 1902)

Characters		Clerc, 1903	Ransom, 1909	Schultz, 1940	Author
Length of strobila		80.0	-	135.0 - 164.0	40.0
Maximum breadth		1.3	-	1.8 - 2.5	0.75
Scolex	Diameter	0.23 - 0.32	0.225 - 0.235	0.29 - 0.38	0.196
Rostellum	Length	-	0.1	0.13 - 0.18	0.210
	Breadth	-	0.05	0.066	0.046
	Bulb diameter	-	0.07	0.085	0.069
Hooks	Number	10	10	10	10
	Size	0.027 - 0.039	0.038	0.039	0.034
Suckers -	Diameter	-	0.08	0.085 - 0.125	0.09
Early segment	Length	-	-	0.08	0.04
	Breadth	-	-	-	0.27
Mature segment	Length	-	-	-	0.098
	Breadth	-	-	-	0.504
Excretory	Dorsal	-	-	-	0.012
	Ventral	-	-	-	0.041
Genital atrium		-	-	-	right
Testes	Number	2	2	2	2
	Size	-	0.1 - 0.13	0.13 - 0.165	0.095 - 0.108
Cirrus sac	Length	0.15 - 0.16	0.18 - 0.28	0.48 - 0.62	0.49
	Diameter	-	0.045 - 0.055	0.045 - 0.06	0.04
Cirrus	Length	-	0.15	-	0.072
	Breadth	-	0.06	0.005	0.012
External seminal vesicle		-	-	-	0.115 x 0.05
Receptaculum seminis		-	-	-	0.17 x 0.07
Ovary		-	0.045 - 0.06	0.07 - 0.14	-
Vitellaria		-	-	-	0.085

Typical dimensions were 0.07 mm. by 0.17 mm. The uterus develops from a transverse tube dorsal to the ovary but beneath the receptaculum seminis. No gravid material was available.

Discussion

Like Hymenolepis (Hym.) anatina (Krabbe 1869), this species is fairly unique in that it occurs as frequently in the Ralliformes as in the Anseriformes. The confusion over the exact definition of acuminata is only increased by Linton's description (1927) of material with rostellar hooks, 0.048 mm. long. As the hook size cannot be related to a particular species of host it is best to consider all species within the range given by Clerc as acuminata. Czaplinski (1956) suggested that ransomi Schultz (1940) is a synonym, but Beverly-Burton (1964) has not followed this conclusion. Schultz created ransomi on the basis of larger hooks, armed suckers and the tri-lobed ovary. The hooks described above are smaller than those of Ransom and Czaplinski but the armed suckers and trilobed ovary are present. These latter features being consistent, it is probable that the actual size of the hooks does vary according to the hosts classification i.e. Ralliform or Anseriform and the writer confirms Czaplinski's tentative synonymy.

The present material is the first record of D. acuminata (Clerc, 1902) in a Coot in the British Isles.

Table 31 lists Ransom's original description as well as Schultz' and Beverly-Burton's redescription of ransomi (1940).

Genus: Aploparaksis Clerc, 1903

Syn. Monorchis Clerc, 1902

Skorikowia von Linstow, 1905

Haploparaksis Neslobinsky, 1911

Haploparaxsis Mayhew, 1925

Clerc (1902) created Monorchis with filum (Goeze, 1782) as type. In 1903 he raised Aploparaksis because Monorchis was already applied to a trematode. Mayhew, favouring etymological accuracy, changed the spelling to Haploparaxsis (1925). In 1952 Wardle and McLeod pointed out that this violates the International Rules for Zoological Nomenclature and the genus has reverted to Aploparaksis. (Yamaguti (1959) continues to favour Haploparaxsis).

32). Aploparaksis brachyphallos (Krabbe, 1869) Clerc, 1903

Syn. Taenia brachyphallos Krabbe, 1869

Taenia filum var. brachyphallos Lönnberg, 1890

Hymenolepis brachyphallos (Krabbe, 1869) Railliet, 1899

Diorchis serpentata von Linstow, 1905 a

Skorikowia clausa von Linstow, 1905 b

Haploparaxsis b. (Kr. 1869) Mayhew, 1925

In the Northern Hemisphere, known Charadriiform hosts include: the Ringed Plover (Charadrius hiaticula L.), the Purple Sandpiper (Calidris maritima (Gmelin) L.), the Knot (Calidris canutus (L)), the Dunlin (Calidris alpina (L.)), the Turnstone (Arenaria interpres L.) and the Jack Snipe (Lymnocryptes minimus (B.)). The species was redescribed by Davies (1940) from the Jack Snipe, near Aberystwyth. It has not been recorded again in Britain until the author found the species in a Knot. The bird was found

dead and washed ashore at Swallow Tree Bay, Saundersfoot in January, 1863. Four scolices were recovered. The strobilae were in bad condition and much contracted. Careful staining and examination made it possible to obtain the following account.

External Morphology

The cestodes are all short, the largest specimen measuring only 20 mm. The maximum breadth was 0.56 mm. The scolex is 0.21 mm. in diameter and quite distinctive in shape: the body of the scolex is rounded and from it emerges the rostellum with a rounded swollen terminal bulb (Figure 115). The rostellum length is 0.142 mm., the breadth is 0.048 mm. and the bulb diameter 0.078 mm. The ten cheliform hooks are 0.017 - 0.019 mm. long (Figure 116), and are characterised by the extension of the finely pointed blade over the downwardly terminating guard. The rostellar sac measures 0.092 mm. by 0.051 mm. and the meagrely developed suckers, 0.065 mm. The neck is 0.045 - 0.05 mm. long and 0.1 - 0.105 mm. across. As the specimens were contracted significant measurements for the proglottids cannot be given; one mature and relaxed segment in which the testis has degenerated and the ovary is fully developed is 0.08 mm. long and 0.3 mm. wide.

Internal Morphology

a). Musculature

Because the material was contracted it was thought to be essential that all the specimens were stained and mounted in their entirety so as to obtain as much intimation of their nature as possible. It was not feasible therefore to make sections.

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Plate 39

Aploparaksis brachyphallos (Kr., 1869)

Figure 115. Scolex. H.P. X 6.

Figure 116. Hook. Oil.

Aploparaksis crassirostris (Kr., 1869)

Figure 117. Hook. Oil.

Figure 118. Cirrus bulb. Oil.

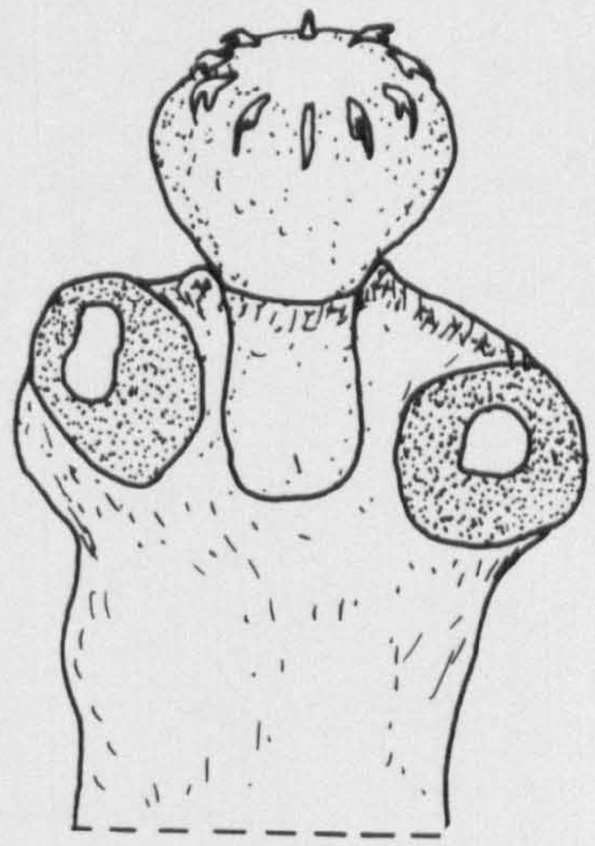
Figure 119. Mature segment. H.P. X 6.

Aploparaksis dujardini (Kr., 1869)

Figure 120. Early mature segment 'male'. H.P. X 6.

Figure 121. Hook. Oil.

115



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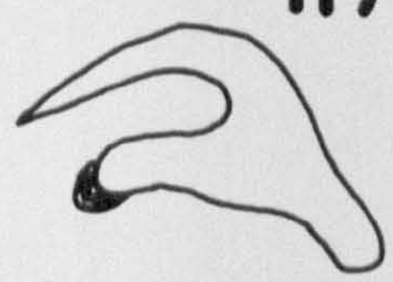
117



0·1 mm.

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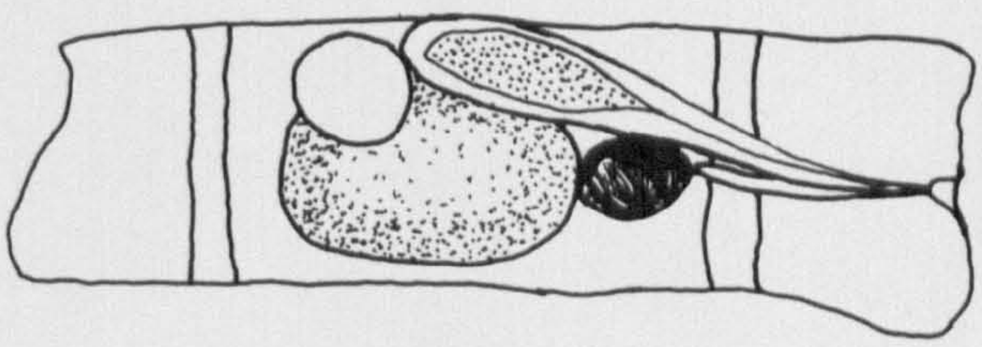
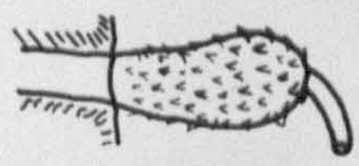
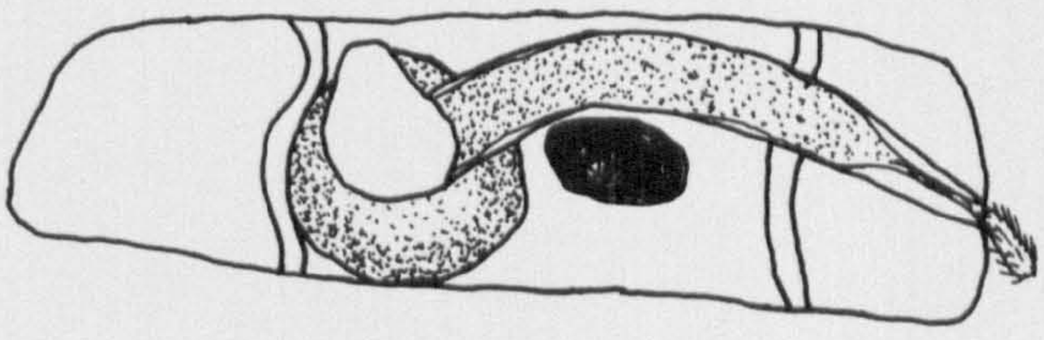


118



120



b). Excretory system

The dorsal vessels are 0.004 mm. diameter in a mature segment and the ventral 0.012 mm. The transverse vessels were not seen.

c). Reproductive system

The genital atrium is found on the right side and is unique in that it is not placed on the lateral margin but some 0.045 mm. from the dorsal edge in each segment. It is wide, shallow and contains the openings of both sets of genitalia, the vagina being postero-ventral to the cirrus sac. The testis is 0.042 mm. in diameter and is slightly poral. From it the vas deferens expands as a dorsally situated external seminal vesicle, 0.057 mm. by 0.035 mm. at the aporal termination of the cirrus sac, before entering the same as a narrow duct. Here it expands to form an internal seminal vesicle. When the testis is fully developed the internal seminal vesicle measures only 0.11 mm., but after the degeneration of the testis it expands to fill nearly two thirds of the sac. The slender, slightly muscular cirrus sac extends beyond the mid-line, 0.211 mm. long and 0.028 mm. broad. The cirrus is everted for 0.04 mm. on some segments and the basal bulb, 0.009 mm. wide, is spined. It terminates in a narrow unarmed 'whip.'

The vagina gradually enlarges to form a receptaculum seminis, 0.057 mm. long on the poral side, beneath and posterior to the cirrus sac. The ovary, which is strongly lobed and bipartite, is the most ventrally situated organ in the segment. Postero-dorsally, the isthmus supports the oval vitelline gland, 0.038 mm. in diameter. The uterus is a narrow, transverse duct in front of the ovary which

rapidly expands to fill the segment. No mature ova were obtained.

Discussion

Davies (1940) published a redescription which differs from the above text in several details. The overall measurements are larger due to the small size and contracted state of this present material. The hooks from this collection are smaller and Davies' makes no mention of the dorsal, sublateral openings of the genital atria. Davies did not find the cirri everted beyond the atria and he failed to notice the spined basal bulb. This latter feature was present in Krabbe's original description. The bitesticulated condition, so well illustrated by Davies, could not be discerned. The species, although close allied to A. filum (Goeze, 1782) may be differentiated from it on the grounds ennumerated by Davies.

The Knot (Calidris canutus (L.)) is a new British host record.

33). Aploparaksis crassirostris (Kr.,1869) Clerc, 1903

Syns. Taenia crassirostris Krabbe, 1869

Dicranotaenia crassirostris (Kr.1869) Stossich,1897

Hymenolepis crassirostris (Kr.1869) Railliet,1899 a

Monorchis crassirostris (Kr.1869) Clerc, 1902

Haploparaxsis c. (Kr. 1869) Mayhew, 1925

Krabbe described Taenia crassirostris from the Common Snipe (Gallinago gallinago L.), the Great Snipe (Gallinago major L.), the Woodcock (Scolopax rusticola L.) and the Marsh Sandpiper (Tringa stagnatalis Bechstein). Clerc (1903) redescribed the species from the Snipe, Woodcock and the Ruff (Philomachus pugnax (L.)). In 1927 McIntosh and Nicoll recorded the species from Britain in the Ringed Plover (Charadrius hiaticula L.), Davies (1937 unpubl.) in the Dunlin (Calidris alpina (L.)) and Baylis (1939) in the Jack Snipe (Lymnocryptes minimus (B.)). Williams (1962) added the Curlew (Numenius arquata (L.)).

The writer has recovered four strobilae from a curlew, November, 1962, two strobilae from a Whimbrel (Numenius phaeopus (L.)) in December, 1962 and two from the Dunlin, October, 1962. All specimens were stained and mounted.

External Morphology

The whitish delicate cestodes were found at the anterior end of the small intestine. The largest was 75 mm. long and 0.52 mm. broad. The scolex is small, not very muscular, 0.196 mm. diameter. The rostellum is short and blunt, 0.115 mm. long and 0.065 mm. across. The terminal bulb has a curious inflated appearance and carries ten cheliform hooks, 0.031 - 0.032 mm. long (Figure 117). The rostellar hooks each bear an appendix on the guard and

occasionally on the root. The rostellar sac extends well beyond the posterior borders of the suckers and is 0.142 mm. by 0.093 mm. The rounded suckers are 0.08 mm. diameter. The neck is 0.15 mm. across and is invariably less than 0.1 mm. long. The specimens showed much variation in size in relation to the various host but a typically mature segment is 0.053 mm. long and 0.346 mm. broad.

Internal Morphology

a). Musculature

The delicate strobilae made unsatisfactory sections.

b). Excretory system

The transverse vessels were not seen out the paired dorsal and ventral were found in all but the most gravid segments. Both pairs are ventral to the genital ducts, the dorsal pair increasing from 0.004 mm - 0.006 mm. and the ventral from 0.012 - 0.019 mm. in diameter.

c). Reproductive system

The genital atrium is a shallow funnel on the right side in the middle of the lateral margin. The single oval testis is in the mid-line and touches the posterior border of the segment. It varies in size but at optimum maturity is 0.109 mm. by 0.057 mm. The external seminal vesicle is anterior and dorsal to the testis on the aporal side. It is muscular and 0.04 - 0.056 mm. in diameter. It connects by a short straight vas deferens to the non-muscular cirrus sac, 0.215 mm. long and 0.22 mm. diameter, (Figure 119) which extends beyond the mid-line in the antero-dorsal region in front of the testis. The internal seminal vesicle occupies initially only half its length, but after degeneration of

the testis and decrease in girth of the external seminal vesicle, it may occupy over three-quarters of the cirrus sac. The cirrus is elongate, up to 0.105 mm. and bears distinct backwardly directed spines, (Figure 118). There is a basal bulb, 0.012 mm. in diameter from which the extended 'whip' emerges. This is frequently inserted into the preceding or following atrium.

The first organ of the female system to develop is the receptaculum seminis which is ventral and posterior to the cirrus sac. Its maximum diameter is 0.049 mm. and it occupies the space between the poral vessels and the mature testis. The vagina is 0.095 mm. long and 0.003 mm. diameter. The ovary develops only after the testis has disappeared and is elongated transversely, 0.137 mm. in diameter. Initially oval, it differentiates into 4 lobed wings, although this may be an artifact dependent upon the state of contraction prevailing. Ventrally and posteriorly is the irregularly outlined vitelline gland, 0.058 mm. in diameter. The gravid uterus is sac-like and envelopes nearly all the available space, extending beyond the vessels which appear to degenerate. The eggs are 0.05 - 0.055 mm. long and the ova 0.026 - 0.03 mm. by 0.023 - 0.025 mm. The embryonic hooks are 0.017 mm. - 0.018 mm. Polar thickenings are evident at full maturity.

Discussion

Krabbe (1869) described rostellar hooks 0.033 - 0.039 mm. long. Clerc (1903) found the hook size to be constant at 0.033 mm. Since his specimens were most closely analagous to Krabbe's fig.203 b, he decided that there were several species and various authors have subsequently attempted to differentiate species from Krabbe's higher

measurements. There has been no published redescription in recent years and no published description of material found in Britain.

The Whimbrel (Numenius phaeopus (L.)) is a new host.

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34). Aploparaksis dujardini (Krabbe 1869) Clerc, 1903

Syn. Taenia dujardini Krabbe 1869

Monorchis dujardini (Krabbe, 1869) Clerc, 1902

Haploparaxsis dujardini (Kr.1869) Mayhew, 1925

Krabbe (1869) described Taenia dujardini from the Songthrush (Turdus philomelos clarkii Hartert). It has been recorded since in nearly every member of the families Corvidae and Turdidae throughout the Northern Hemisphere. British records are the Blackbird (Turdus merula L.) - Baylis 1928, Davies 1937 unpubl., Evans 1938 unpubl.; the Songthrush - Baylis, 1928, Evans 1938 unpubl.; the Starling (Sturnus vulgaris L.) - Baylis, 1928, Davies 1937 unpubl., Evans 1938 unpubl., Baylis 1939, Mettrick 1958; and the Redwing (Turdus musicus L.) Evans 1938 unpubl., Baylis 1939. The Welsh records are those of Davies, 1937 and Evans 1938.

The writer's specimens are from the Raven (Corvus corax L.) - two strobilae in March 1963; the Starling - numerous strobilae from several dozen birds; the Fieldfare (Turdus pilaris L.) - eight from two birds, March 1963; the Redwing - eleven from four birds, March 1963; the Blackbird - eight from four birds, November 1960, July 1961, November 1962 and May 1963; the Hedge Sparrow (Prunella modularis (L.)) - one in November 1961; the Wren (Troglodytes troglodytes (L.)) - two in August 1962 and the Pied Wagtail (Motacilla alba yarellii Gould) - one immature August, 1963.

External Morphology

The material from most birds was relaxed and elongated, up to 70 mm. but that from the Redwing was much contracted and only

immature strobilae were obtained from the Hedge Sparrow, Wren and Pied Wagtail. The maximum breadth was 0.84 mm. and the scolices averaged 0.26 mm. The rostellum is short and stout, 0.207 mm. by 0.085 mm. and the terminal bulb is 0.103 mm. in diameter. Approximately forty-six cheliform hooks, 0.018 mm. long, are found in an undulating circle on the bulb (Figure 120). The suckers are unarmed and comparatively inconspicuous, 0.069 - 0.097 mm. across. The neck is elongate and leads into an extensive region of immaturity. A typical mature segment is 0.087 mm. long and 0.282 mm. wide, while a gravid is 0.138 mm. and 0.7 mm. respectively.

Internal Morphology

a). Musculature

There are two layers of longitudinal muscles on which the outer layer is narrow and continuous and the inner layer divided into at least thirty large bundles.

b). Excretory system

The dorsal vessel has a diameter of 0.007 mm., and the ventral of 0.013 mm.

c). Reproductive system

The genital atrium is unilateral on the left side of the strobila. It is fairly shallow and lies in the second third of the segment. The single testis is 0.055 - 0.073 mm. diameter and aporal (Figure 121). Above and anterior at the aporal end of the cirrus sac is the external seminal vesicle. This varies greatly in size from segment to segment and its lack of musculature suggests a swollen vas deferens rather than a definite organ.

It leads into a cirrus sac, 0.185 - 0.212 mm. long and 0.073 mm. in diameter, The internal seminal vesicle expands to fill more than two-thirds of the sac. The cirrus is spined and can be everted for at least 0.06 mm.

The vagina passes inwards beneath the cirrus and expands to form a receptaculum seminis which at maturity is 0.038 mm. by 0.065 mm. The ovary is lobed, ventral and posterior to both the cirrus sac and the receptaculum seminis. It is median and does not extend to the canals. The vitelline gland lies unexpectedly, beneath the testis on the aporal side, rather than in the mid-line above the ovary. It is 0.029 mm. long and 0.042 mm. across. The uterus is at first a transverse sac on the posterior ventral side of the segment but as it expands, it extends dorsally over the excretory vessel. The eggs are 0.031 mm. but the embryonic hooks were not developed.

Discussion

Yamaguti (1935) described a deeply lobed ovary and Mettrick (1958) has described a slightly lobed ovary. In the present collection which is fully relaxed and well preserved, the ovary is distinctly lobed but not as fully as Yamaguti suggests. The material corroborates Yamaguti's statement that the sucker measurements are very variable. The cirrus sac is longer than stated by Yamaguti who found it to reach only to the mid-line. This is true only when the cirrus is fully everted and the cirrus sac contracted, otherwise the sac extends to the aporal vessel. The dorsal excretory vessel, not mentioned by Mettrick (1958), is considerably smaller than Fuhrmann's recorded 0.027 mm. (1895).

The Raven (Corvus corax L.), the Fieldfare (Turdus pilaris L.), the Hedge Sparrow (Prunella modularis (L)), the Wren (Troglodytes troglodytes (L.)) and the Pied Wagtail (Motacilla alba yarrellii Gould) are all new host records.

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35). Aploparaksis filum (Goeze, 1782) Clerc, 1903

Syns. Taenia filum Goeze, 1782

Taenia filum var polybari, Lönnberg, 1896

Hymenolepis filum (Goeze, 1782) Railliet, 1899a

Drepanidotaenia filum (Goeze, 1782) Conn, 1901

Monopylidium filum (Goeze, 1782) Parona, 1902

Monorchis filum (Goeze, 1782) Clerc, 1902

Haploparaxsis f. (Goeze, 1782) Mayhew, 1925

Clerc (1903) nominated Taenia filum Goeze (1782) as the genotype of the new genus Aploparaksis. It has been recorded in Charadriiformes throughout the world, and from Britain in the Ruff (Philomachus pugnax (L.)) by Bellingham (1844); the Common Snipe (Gallinago gallinago L.) by Davies (1940) and Baylis (1939); the Jack Snipe (Lymnocryptes minimus (B.)) and the Woodcock (Scolopax rusticola L.) by Baylis (1939); the Dunlin (Calidris alpina (L.)) by McIntosh and Nicoll (1927) and Davies (1940), and the Curlew (Numenius arquata (L.)) by McIntosh and Nicoll (1927) and Pemberton (1960).

The writer recovered ten strobilae in seven Curlew - November 1960, December, 1960, January, 1961 (two birds) and November, 1962 (three birds); two strobilae from a Redshank (Tringa totanus L.) - January, 1962; two from a Woodcock - December, 1963 and fifteen from seven Common Snipe - January, 1961, November, 1962 (two birds), December, 1962, and January, 1963 (three birds).

External Morphology

The cestodes are up to 25 mm. long and 0.56 mm. wide. The scolex is small and round, 0.198 mm. in diameter with a robust

muscular rostellum 0.125 mm. long and 0.06 mm. broad (Figure 123). The rounded terminal bulb (0.093 mm.) bears ten cheliform hooks, 0.018-0.025 mm. long (Figure 122) and the rostellar sac is 0.179 mm. long and 0.066 mm. diameter. The suckers are small and only poorly developed 0.055 - 0.086 mm. The neck may be very elongated and thin 0.55 mm. by 0.58 mm. or it may be short and much contracted. The immature segments are found at a distance from the scolex and the long time taken to reach maturity seems uniformly unrelated to the degree of crowding or the amount of food available. An immature segment is 0.024 mm. by 0.156 mm. and a mature is 0.097 mm. by 0.156 mm. A gravid is 0.19 mm. long and 0.425 mm. across.

Internal Morphology

a). Musculature

No sections were made.

b). Excretory system

The paired dorsal vessels were not visible in whole mounts. The ventral vessels are 0.016 - 0.027 mm. in diameter according to the age of the segment. The transverse vessel is 0.027 mm.

c). Reproductive system

The genital atria occur unilaterally on the right side of the strobila and are found in the second third of the segment. 'Protandry' is extremely marked with a considerable region of the strobila containing only the testis, cirrus sac and the external seminal vesicle, together with the primordia of the vagina and receptaculum seminis. The testis occupies almost the whole of the medulla of the young segment, overlapping the adjacent segments. As growth continues the testis is displaced to the posterior end

but remains in the mid-line. It is 0.049 - 0.056 mm. at maximum maturity. The external seminal vesicle is a sac, 0.052 - 0.06 mm. long against the aporal vessels and is displaced dorso-posteriorly to the cirrus sac. This last organ extends across the parenchyma from near the aporal vessels, to the atrium. It is 0.181 - 0.207 mm. long and contains an extensive internal seminal vesicle occupying at least half the volume of the sac, and distally a long coiled cirrus. This is spined but not everted. In the gravid segment it is possible to discern a remarkably strong musculature extending from the sac and inserted in the aporal wall.

The vagina is 0.1 mm. long and 0.005 mm. in diameter along most of its length but it expands into an oval receptaculum seminis, ventral to the cirrus sac. The isthmus of the bipartite ovary is found slightly to the left of the mid-line. It is 0.18 mm. across and each wing is coarsely lobed; ventrally the compact vitelline gland is discovered, 0.063 mm. by 0.039 mm. The uterus develops as a lobed transversely extended sac which passes beneath the vessels on either side. Ultimately the egg develops, 0.032 mm., with hooks 0.011 mm. long and is distinguished by polar thickenings.

Discussion

Davies (1940) redescribed the species and this text corroborates much of his detail. The main discrepancies are the narrowness of the strobilae in the mature and gravid regions. Davies particularly mentioned finding gravid material in the caeca of the host. This was not true of the present collection in which all stages occurred in the small intestine.

The Redshank (Tringa totanus L.) is a new British host record.

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Plate 40

Aplolaraksis filum (Goeze, 1782)

Figure 122. Hook. Oil.

Figure 123. Scolex. H.P. X 6.

Aploparaksis furcigera (Nitsch in Rud., 1819)

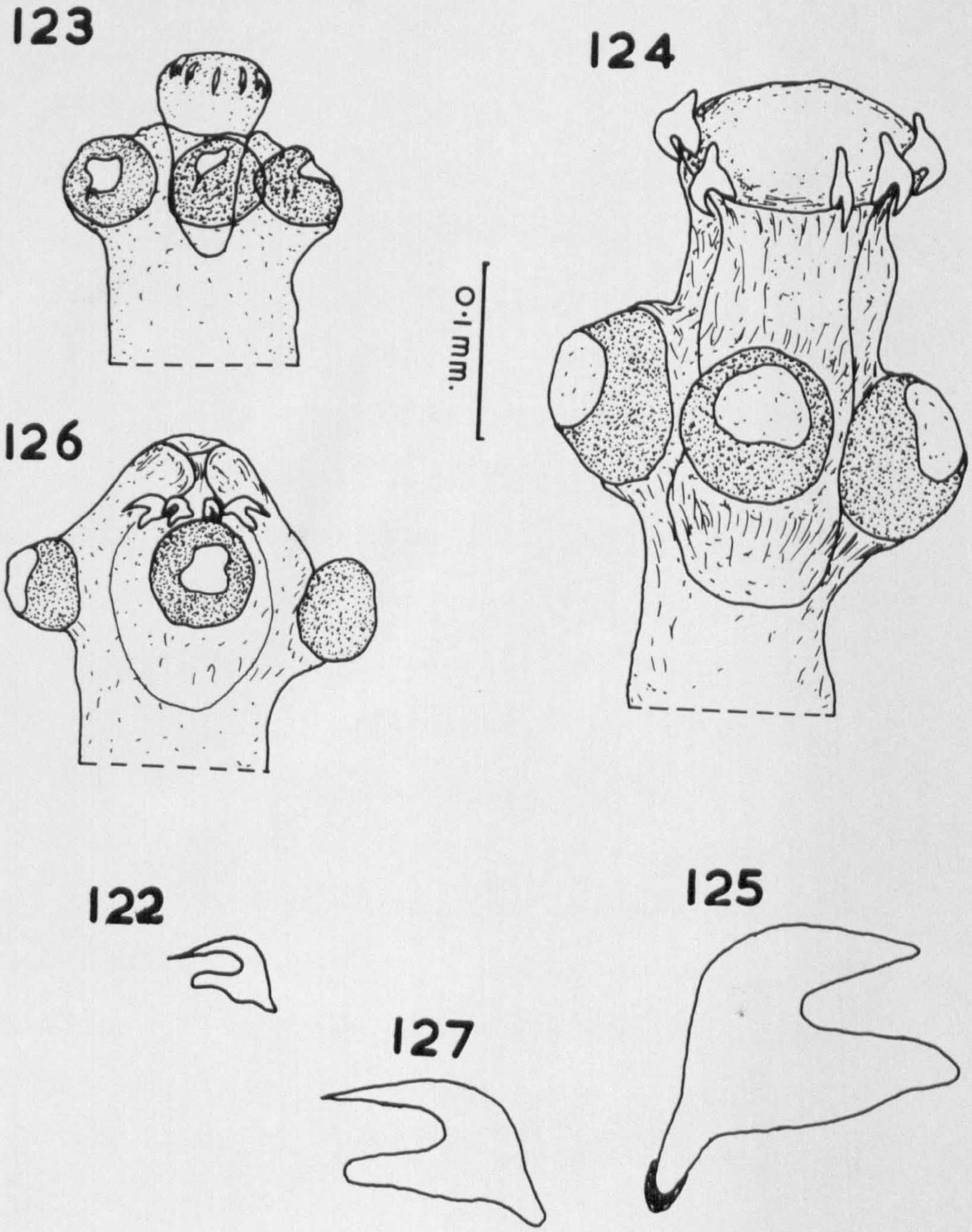
Figure 124. Scolex. H.P. X 6.

Figure 125. Hook. Oil.

Aploparaksis hirsuta (Krabbe, 1882)

Figure 126. Scolex. H.P. X 6.

Figure 127. Hook. Oil.


123
124
0·1 mm.
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122
125
127

36). Aploparaksis furcigera (Nitsch in Rud.,1819)Fuhrmann,1908

Syn. Taenia furcigera Nitsch in Rudolphi, 1819

Taenia rhomboidea Dujardini, 1845

Dicranotaenia rhomboides (Duj.,1845) Railliet,1893

Dicranotaenia f. (Nitsch) Stiles, 1896

Hymenolepis furcigera (Nitsch) Railliet, 1899a

Haploparaksis f. (Nitsch) Fuhrmann, 1926

Haploparaksis f. (Nitsch) Mayhew, 1925

Aploparaksis pseudo-furcigera Skrjabin et Mathevossian, 1945

Taenia furcigera was first described from the Mallard (Anas platyrhynchos L.) and subsequently by Krabbe (1869) from the same host in Iceland. Amongst many Anseriform hosts are the Formosa Teal (Anas formosa Georgi), the Grey Lag Goose (Anser anser L.), the Gadwall (Anas strepera L.), the Pintail (Anas acuta L.), the Red-crested Pochard (Aythya rufina (Pallas)), the Teal (Anas crecca L.) and the Pochard (Aythya ferina (L)). The first occurrence in Britain was in the domestic duck (Anas platyrhynchos dom. L.) recorded by Davies (1937 unpubl.), while Williams (1962) recorded the species in the Mallard. Beverly-Burton (1964), records the species from Suffolk, Berkshire and St. James Park, London, in the Mallard and from Berkshire in the Wigeon (Anas penelope L.). The writer recovered three strobilae from a Mallard in December 1962.

External Morphology

The cestodes are whitish, 25 - 45 mm. long and 0.63 mm. broad. The scolex is 0.255 mm. in diameter and the species is instantly

recognised by the large characteristic rostellum, 0.228 - 0.483 mm. long (Figure 124). The breadth of the rostellum is at least 0.125 mm. and that of the terminal bulb, 0.132 mm. The rostellar sac is elongate and extends into the neck. Ten cheliform suckers, 0.052 mm. long, encircle the terminal bulb (Figure 125). The suckers are small and circular, 0.082 - 0.12 mm. and without spines. The neck may be up to 0.32 mm. long and 0.13 mm. across. The immature segments are 0.048 mm. by 0.212 mm., the mature 0.14 mm. by 0.365 mm. and the gravid 0.15 mm. by 0.63 mm.

Internal Morphology

a). Musculature

Sections were not made.

b). Excretory system

The dorsal vessels vary between 0.004 mm. and 0.007 mm. and the ventral vessels between 0.011 mm. and 0.021 mm. The transverse vessels were not traced.

c). Reproductive system

The genital pore opens on the right side and is a shallow funnel in the second half of the segment. The analagen of the testis and cirrus sac are found by the 45th. segment. The testis is median and oval, 0.13 mm. by 0.06 mm. at maturity. A vas deferens leads to a small external vesicle which overlaps the aporal vessel and is weakly muscular, 0.043 - 0.063 mm. in diameter. The cirrus sac occupies at least two-thirds of the segment and is slender and non-muscular. At optimum development it measures 0.19 mm. by 0.018 mm. and contains a voluminous interior seminal vesicle which increases in size to fill the sac as the testis degenerates. The

TABLE 32: Aploparaksis furcigera (Nitsch in Rud., 1819)

Characters		von Linstow, 1905	Czaplinski, 1956	Beverley-Burton 1964	Author
Length of strobila		11.2	18.0 - 34.0	68.0	25.0 - 45.0
Maximum breadth		0.053	-	0.7 - 1.1	0.63
Scolex	Diameter	0.4	0.42 - 0.51	0.16 - 0.3	0.255
Rostellum	Length	0.1	0.19 - 0.23	0.23 - 0.25	0.228 - 0.483
	Breadth	-	-	0.12 - 0.13	0.125
	Bulb diameter	-	-	-	0.132
Hooks	Number	10	10	10	10
	Size	0.054	0.052 - 0.057	0.051 - 0.056	0.052
Rostellar sac		-	-	0.11 - 0.17	-
Suckers -	Diameter	-	0.14 - 0.17	0.12 - 0.16	0.082 - 0.112
Early segment	Length	-	-	0.13	0.048
	Breadth	-	-	0.38	0.212
Mature segment	Length	-	-	0.21	0.14
	Breadth	-	-	0.66	0.365
Gravid segment	Length	-	-	-	0.15
	Breadth	-	-	-	0.63
Excretory	Dorsal	-	-	0.005 - 0.007	0.004 - 0.007
	Ventral	-	-	0.018 - 0.022	0.011 - 0.021
Genital atrium		-	-	right	right
Testes	Size	-	-	0.14	0.13 x 0.06
Cirrus sac	Length	-	0.18 - 0.283	-	0.19
	Diameter	-	0.022 - 0.031	-	0.018
Cirrus		-	armed	armed at base	unarmed
External seminal vesicle		-	-	0.09 - 0.1	0.043 - 0.063
Receptaculum seminis		-	-	-	0.051
Ovary		-	-	0.33	-
Vitellaria		-	-	-	0.037
Envelope		-	0.032 - 0.038	0.036 - 0.038	0.032 - 0.036
Ova		-	-	-	-
Hooks		-	0.015	0.012 - 0.014	0.011 - 0.113

cirrus was not everted and no evidence of spination was seen within the sac.

The receptaculum seminis is posterior and ventral to the cirrus sac, just within the aporal vessel. It attains a maximum diameter of 0.051 mm. The ovary is lobed and bipartite on the ventral side of the segment with the isthmus in the mid-line. The vitelline gland is compact and perfectly spherical, 0.037 mm. in diameter, posterior to the ovary. The uterus occupies the entire segment, with eggs 0.032 - 0.036 mm. in diameter. The hooks are 0.011 mm. long.

Discussion

The writer's measurements are listed in Table 32 alongside those of von Linstow (1905), Czaplinski (1956) and Beverly-Burton (1964). The various accounts are not compatible over the armature of the cirrus. Skrjabin and Mathevossian (1945) state unarmed cirrus while Czaplinski (1956) describes armed cirri. This discrepancy may be accounted for by Beverly-Burton's assertion that the cirrus is armed at the base, a feature which would be most noticeable only on full eversion of the cirrus. Skrjabin and Mathevossian (1945) created A. pseudo-furcigera for species which differed in the shape of the handle of the rostellar hooks, larger hooks (0.063 mm.) and testes measuring 0.067 - 0.072 mm. in diameter. Czaplinski (1956) considers the species a synonym for A. furcigera and this is supported by the writer.

37. Aploparaksis hirsuta (Krabbe, 1882) Clerc, 1903

Syn. Taenia hirsuta (Krabbe, 1882)

Taenia pubsescens (Krabbe, 1882)

Monorchis hirsuta (Krabbe, 1882) Clerc, 1902

Hymenolepis hirsuta (Kr. 1882) Fuhrmann, 1908

Haploporaxsis h. (Kr.1882) Mayhew, 1925

This species has been recorded from the Great Snipe (Gallinago major (Gmelin)), the Common Snipe (Gallinago gallinago L.) and Green Sandpiper (Tringa ochropus (L.)).

Davies (1937, unpubl.)recorded this species from the Jack Snipe (Lymnocryptes minimus (Brünnich)). The present material was recovered from the Common Snipe. A single immature strobila was found entangled with Paricterotaenia stellifera (Kr.1869) in November, 1962.

External Morphology

The small immature strobila in which segmentation had scarcely commenced was stained and mounted. It is 9 mm. long and 0.112 mm. wide. The scolex is 0.218 mm. in diameter and bears a large retracted rostellum (Figure 126). There are ten cheliform hooks 0.039 mm. long (Figure 127). The suckers are weak and non-muscular, 0.058 mm. in diameter. The neck is extremely long, up to 6 mm. The genital primordia show clearly that the pores are unilateral.

Discussion

Identification has been based on the hook measurements and presence of unilateral pores. The Common Snipe(Gallinago gallinago L.) is a new host record for Britain.

Sub-family: Fimbriariinae Wolffhügel, 1900

Genus: Fimbriarioides Fuhrmann, 1932

38). Fimbriarioides intermedia (Fuhrmann, 1913) Fuhrmann, 1932

Syn. Fimbriaria intermedia Fuhrmann, 1913

Fimbriaria intermedia was described from the Eider duck (Somateria mollissima (L.)) in the collection of the Gothenburg Museum in 1913. In 1932, Fuhrmann created the genus Fimbriarioides to include intermedia and falciformis, Linton, 1927, the generic characters being the primordia in the pseudo-scolex, eight to eleven excretory vessels, a reticulate ovary and distinct internal segmentation. Wolffhügel (1936) erected the genus Fimbriariella for falciformis but Webster (1943) has re-examined the types and paratypes and found two distinct species to be present. The second species he has described as Fimbriarioides lintoni Webster, 1943 and in the same paper he recorded F.haematopodi Webster, 1943 from the Black Oystercatcher (Haematopus bachmani ?).

The writer's specimens were recovered from the small intestine of the Eider Duck in February, 1963.

External Morphology

The white fleshy cestodes are 50 mm. long and 2 - 4 mm. wide. The scolex is very small, 0.105 - 0.111 mm. diameter(Figure 129). The suckers are weakly developed, 0.046 mm. in diameter and anteriorly directed. The rostellarsac is 0.068 mm. long and 0.041 mm. wide. The rostellum is 0.135 mm. long and 0.018 mm. thick with a terminal bulb 0.041 mm. across. There are ten claviform hooks, 0.018 mm. to 0.021 mm. long. Behind the scolex is the large pseudoscolex which is a curious compromise between a

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Plate 41

Fimbriarioides intermedia (Fuhrmann, 1913)

Figure 128. Pseudoscolex. L.P. X 6.

Figure 129. Scolex. H.P. X 10.

Hymenolepis spp.

Figure 130. Hook. Oil.

Hymenolepis spp.

Figure 131. 'Male' segment. H.P. X 6.

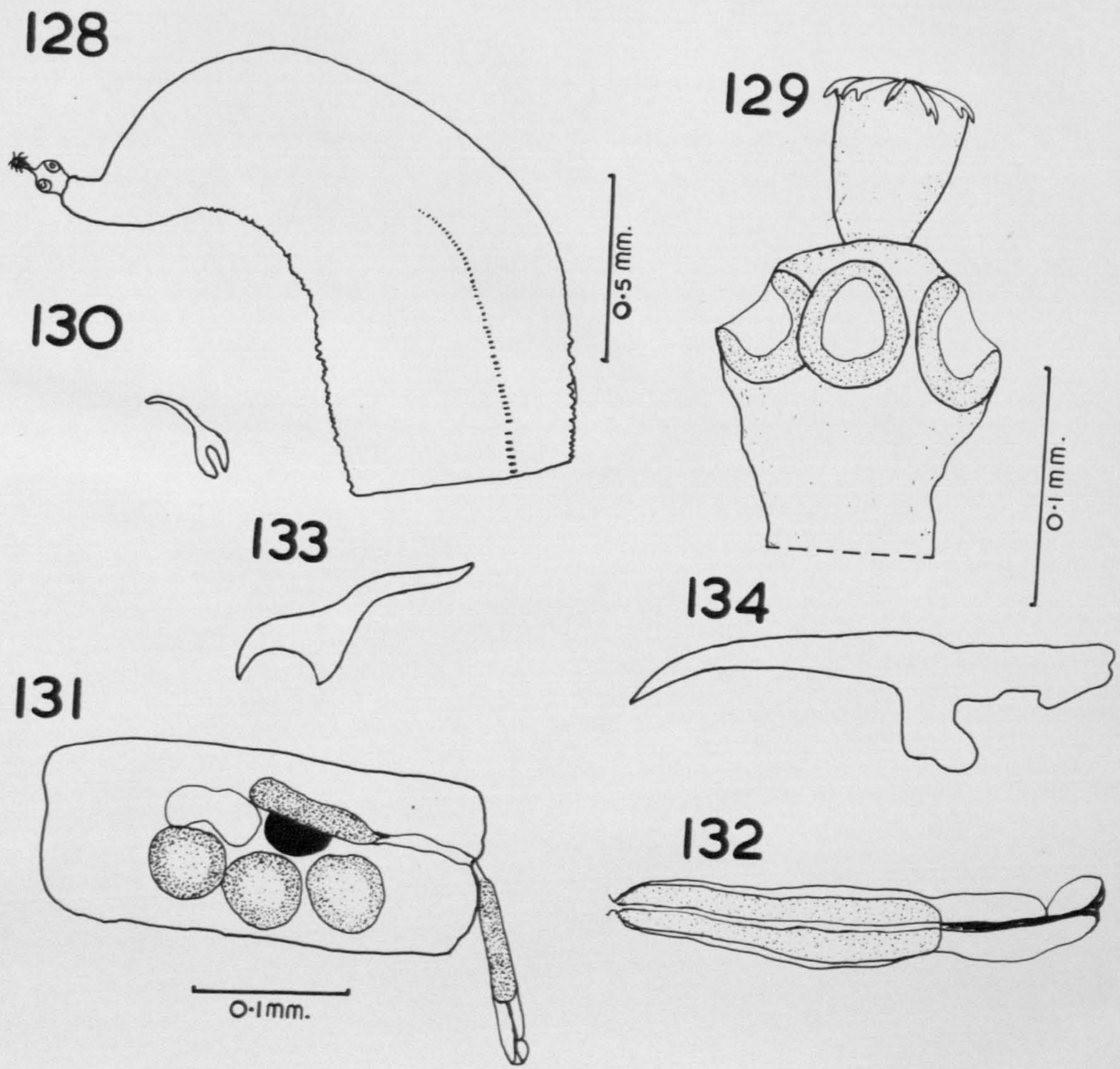
Figure 132. Cirrus. Oil.

Dilepis spp.

Figure 133. Hook. Oil.

Dilepis spp.

Figure 134. Hook. H.P. X 10.


128
129
130
133
134
131
132
0·5 mm.
0·1 mm.
0·1mm.

triangle and a half-moon, (Figure 128). It differs markedly from the pleated pseudo-scolex of Fimbriaria. The concave edge is strongly scalloped while the convex side is comparatively smooth. Seven of the eight scolices have the genital atria developed on the convex side and the primordia are evident within the pseudoscolex itself. There is no 'neck' since segmentation is not significant and genital development is evident in the pseudo-scolex. A sexually mature section of the strobila is 1 - 2 mm. wide and a gravid up to 3 mm. wide.

Internal Morphology

a). Musculature

No sections were made.

b). Excretory system

There are eight or nine longitudinal vessels, 0.011 - 0.016 mm. wide which anastomose quite irregularly.

c). Reproductive system

The genital atria are found unilaterally on the left side of the strobila. There is marked protandry and the three oval testes lie alongside each other in the middle region of the strobila. The outline is somewhat irregular but at optimum maturity each measures, 0.019 mm. long and 0.075 mm. wide. The external seminal vesicle which is found antero-dorsally between the poral and midule testis has no distinct musculature. It is to all intents and purposes a swelling of the vas deferens and did not exceed 0.07 mm. by 0.044 mm. The cirrus sac is variable in length, 0.165 - 0.226 mm. and is very muscular. The internal seminal vesicle occupies two-thirds of the sac, the remainder being the cirrus. This is seen as a terminal

cone of spines, filling the cavity of the genital atrium. The spines are backwardly directed and the cirri were not everted in any section of the strobilae.

Ventrally to the cirrus is the vaginal opening, which is a large sphincter, 0.019 mm. in diameter with cuticular lips, 0.003 mm. wide. The vagina is 0.005 mm. wide and at the ventral end of the cirrus sac as it extends towards the mid-line, it enlarges to form the voluminous receptaculum seminis, 0.074 mm. wide and 0.14 mm. long. This conspicuous organ is found together with the cirrus sac even in the gravid segments. The ovary is segmented and reticulated, beneath the other organs, 0.21 mm. long. It appears to be fully developed only in those late sections of the strobila in which the testes have degenerated and the receptaculum seminis is swollen. The vitelline gland, lobed and ventral to the ovary, is 0.1 mm. long. The uterus is reticulate and not restricted to a serial repetition of parts as are the other genitalia. The eggs are 0.022 mm. in diameter with a yellow shell, 0.002 mm. thick. Embryonic hooks were not seen.

Discussion

This is the first description of the rostellar hooks which were missing in Fuhrmann's material. The range, 0.018 mm. to 0.021 mm. is larger than Webster's measurement for lintoni (0.0185mm.) but smaller and of a different shape from those of haematopodi (0.022 mm.). These latter species both possess lobed testes, lintoni has more excretory vessels, a smaller number of longitudinal vessels and smaller onchospheres, while haematopodi has two layers of longitudinal muscles and onchospheres twice the diameter of

intermedia. The extreme homogeny of the genus makes the above characters of dubious value however and further work should be undertaken to determine the range of variation obtaining. This is the first British record of the genus and the first redescription of intermedia, other workers having copies Fuhrmann's original account.

Unidentified Cestodes

39). Hymenolepis sp.

From the Tufted Duck (Aythya fuligula (L.)) in which solowiow Skrjabin, 1914 was found, came a broken contracted strobila, 15 mm. long and 0.414 mm. wide. In the gravid posterior segments, it is possible to discern unilateral pores. The scolex is 0.168 mm. wide and has four muscular unarmed suckers, 0.06 mm. in diameter. The rostellum is 0.071 mm. long and the swollen terminal bulb, which is 0.063 mm. wide, has twenty-one small hooks, 0.015 mm. long (Figure 130). It was not possible to distinguish the testes.

40). Hymenolepis sp.

Fragments of a species of Hymenolepis with three distinct testes were found in a Common Snipe (Gallinago gallinago L.). There were no scolices. Figure 131 illustrates as much as it is possible to derive from this material which is more than worthy of attention because of the uniqueness of the cirrus. The writer has found nothing similar from the present collection of Hymenolepididae, nor has the literature revealed a comparable structure. The material was partially digested and took the stain badly. Under oil emersion the cirrus may be interpreted as follows:

An enclosing tubular membrane into which the internal seminal vesicle is either partially everted or which contains a sausage-shape body acting as an additional seminal vesicle. Terminally an elongated funnel which appears by light refraction to be supported by two or more probably three rods. The membrane is indented where the funnel attaches to the main body, (Figure 132).

This structure is so different from the thin, spined cirrus with a basal bulb common to most of the species that it was decided to include a description and figure despite the lack of hooks and inadequacy of the material.

41). Dicranotaenia spp.

From the Pochard (Aythya ferina (L.) and the Common Scoter (Melanitta nigra (L.)) was recovered a species of Dicranotaenia. No scolices are present. Three lobed testes occupy a straight line in the posterior half of the segment. There is a difference in length of the cirrus sac dependent upon the host but this may be due to differential contraction. The sacculus accessorius is well developed.

42). Dilepis spp.

In December, 1961, a single strobila was recovered from a Starling (Sturnus vulgaris L.). It was very brittle and contracted. The scolex has diameter of 0.29 mm. and bears a short round rostellum. There are twenty hooks in a double row, each 0.042 mm. long, (Figure 133). The suckers are weakly muscular, unarmed, 0.11 mm. across. The testes were not seen but the cirrus sac is 0.165 mm. by 0.033 mm. and the genital atria are unilateral. The receptaculum seminis is 0.049 mm. by 0.079 mm. and the vitelline gland 0.029 mm. by 0.045 mm. A typical gravid segment is 0.588 mm. wide and 0.058 mm. long and contains thick-walled eggs, 0.029 mm. in diameter with embryonic hooks 0.007 mm. long. It is not possible to assign the material to a species.

43). Dilepis sp.

A scolex and fragment of strobila was recovered from a Heron

(Ardea cinerea L.). The scolex is 0.672 mm. in diameter and has four muscular suckers, 0.276 mm. across. There is a large rostellar bulb, 0.29 mm. diameter with 16 - 18 hooks (several are missing), 0.218 mm. long (Figure 134). These are characterised by a distinctive downward projecting root. The greatly contracted segments possess unilateral genital pores.

The only Dilepids on record from the Heron are D.unilateralis (Rud., 1819) and Gryporhynchus cheilancristrostrus (Wedl,1855) both of which have considerably small rostellar hooks.