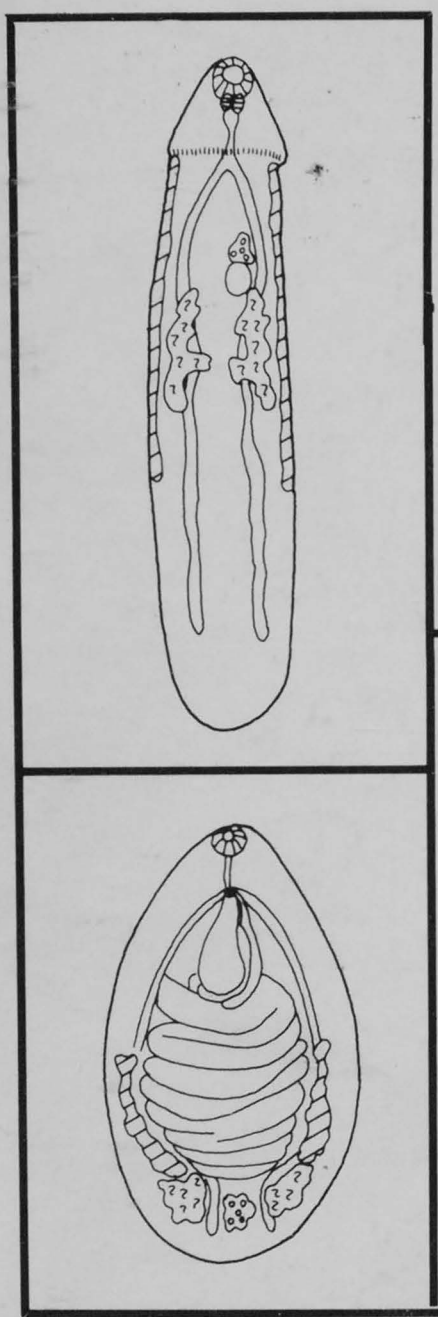
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Key to Trematodes Reported in Waterfowl



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Key to Trematodes Reported in Waterfowl

by Malcolm E. McDonald

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

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Key to Trematodes Reported in Waterfowl

by

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Introduction

This key is the second in a series for identification of the helminths reported in waterfowl (Family Anatidae, Order Anseriformes). The first was a key to nematodes (McDonald 1974).

The trematodes show the greatest variety of forms among the helminth parasites of waterfowl, including over half of all species reported; sometimes this group also includes the greatest part of the worms in a single bird. Over 500 species of trematodes have been reported in waterfowl. Almost all of these have been included in the present set of keys; it was not possible, however, to obtain the descriptions of a few forms (7 of 525).

Comments made in the nematode key relative to the occurrence of nematodes in waterfowl are also true of trematodes:

- No general key for identification has been available.
- The worldwide distribution of the host family and of some anserine species has resulted in worldwide distribution of many of the parasites.
- Many species of helminths are normally in other types of birds, and occur only accidentally in waterfowl (and additional species will be found in this category).
- Although distribution of species is sometimes worldwide, knowledge of this distribution is much restricted. Only birds of Europe and northern Asia have been thoroughly studied for parasites, followed by those in North America and the Oriental region, whereas birds in South America, Africa, and Australia have been least studied.
- Information on such aspects as life histories, hosts, and synonymy may be obtained from the author's *Catalogue of Helminths of Waterfowl* (McDonald 1969*b*).
- Complete citations of the literature can be found in McDonald (1969*a*).

Supplements to the catalogue and bibliography may be issued after this series of keys is completed; about 150 species of helminths, including 102 trematodes, have been added since the catalogue was published. (About 60 trematode names have been reduced to synonymy also.) The present key cites about 70 additional sources for trematode descriptions, and 20 reporting mortality and pathology in waterfowl.

Frequency of occurrence of the trematodes (in waterfowl only) is stated in the checklist as rare (reported only once or twice), infrequent, frequent, common, and characteristic. Species which probably do not normally occur in waterfowl are marked accidental (98 in the checklist); those known in waterfowl only as a result of experimental infection are marked experimental (70). A very few of the experimental infections involved waterfowl only as intermediate or paratenic hosts of larval stages. Although most infections are in wild birds, infections in domestic waterfowl are commonly reported also, and over 50 trematode species have been observed only in domestic waterfowl. Of the 357 species listed as normal or more or less to be expected in waterfowl, 220 are rare and 85 are infrequent; only 50 species occur frequently or more often.

In the keys, a statement is made for each parasite genus regarding taxonomic status of any name reported in waterfowl but not included. Many names have been eliminated as synonyms, others have been transferred to other genera, and some names were based on erroneous information. Synonymy sometimes applies only to the name reported in waterfowl (e.g., *Notocotylus chionis*) and not to all records of the species.

A table of pathogenic forms is included. Observations on pathogenicity of helminths are fragmentary and confused; almost invariably infections are mixed, helminth infection is secondary to some other condition, or the pathogenic effects of helminth infection may be obscure. Pathology may often be severe but not lethal. Effects in domestic and captive birds are often more destructive than in wild birds.

Severe and repeated epizootics in wild waterfowl have been caused by *Sphaeridiotrema globulus* and *Cyathocotyle bushiensis*. Mass die-offs of eiders due to parasitic infections are reported regularly; usually the agents are acanthocephala and coccidia, but trematodes also are responsible, and several species have been involved, as reported by Kulachkova (1954, 1961, and 1973) and others. An epizootic in wild ducks was attributed to *Maritrema*

acadiae in 1933 (Swales 1933); this species has only recently been found again.

Although waterfowl are commonly transferred between continents by man, transfer and permanent establishment of waterfowl parasites in new continents has not been known until recently. Introduction of snails and other invertebrates is permitting the establishment of helminths who use them as intermediate hosts. *Cyathocotyle bushiensis* was recently recognized in Canada, following establishment of its snail host (Gibson et al. 1972); *Philophthalmus gralli* has appeared in waterfowl in Texas, following naturalization of its snail host (Nollen and Murray 1978). *Notocotylus gippyensis*, observed once in England, perhaps appeared there after introduction of its snail intermediate host from New Zealand (Bisset 1977).

Again, as with the nematodes, these keys are based on published descriptions. Many species cannot be clearly separated, perhaps because they are really synonyms, because the proper characters were not chosen, or because the descriptions are faulty or inadequate. I have seen only a comparatively few species. Since the true significance of many recorded species differences are unknown, the final species distinctions in the keys include as many differences as could be noted, even though many are undoubtedly fortuitous and insignificant.

In order to increase the usefulness of this publication, an attempt has been made to cite a description for every reported species. In general the starting point is the series "*Osnovy Trematodologii*, v 1-21, 1947-1963," published by the Academy of Sciences, USSR. With few exceptions additional papers are listed only if they were published after the pertinent volume of that series was issued. All citations on pathology and mortality are placed in a separate section of the references, since few are cited other than in Table 1.

Table 1. *Lethal and Pathogenic Trematodes*

Parasite	Condition reported	Citation
Cyathocotyle bushiensis	Epizootics	Gibson et al. 1972
Cyathocotyle orientalis	Experimental – death, pathology	Faust 1922
Cyathocotyle sp.	Death, pathology	Shevtsov 1958
Apatemon gracilis	Death with multiple infection	Persson et al. 1974; Trofimov 1962
Cotylurus cornutus	Pathology, death with multiple infection	Feng 1931; Persson et al. 1974; Zajíček 1963
Cotylurus flabelliformis	Pathology	Gower 1938; Van Haitsma 1931
Cotylurus platycephalus	Death with multiple infection	Endrigkeit 1940
Parastrigea robusta	Pathology	Odening 1965
Bilharziella polonica	Pathology, death with multiple infection	Heinemann 1936; Litvishko and Pustovar 1960
Bilharziella indica	Pathology	Lal 1937
Dendritobilharzia pulverulenta	Death	Cheatum 1941
Dendritobilharzia sp.	Pathology, death	Levine et al. 1956
Trichobilharzia kowalewskii	Death with multiple infection	Szidat 1938
Trichobilharzia elvae	Pathology, death	McMullen and Beaver 1945; Macy et al. 1955
Trichobilharzia ocellata	Pathology, death	McMullen and Beaver 1945
Typhlocoelum cucumerinum	Death, epizootic	Barry 1959; Gower 1938; Magalhães 1899; Megnin 1890
Typhlocoelum sisowi	Death	Potemkina 1960
Gymnophallus somateriae	Death with multiple infection	Persson et al. 1974
Ribeiroia ondatrae	Death	Leibovitz 1962
Echinochasmus beleocephalus	Epizootic	Shevtsov 1965
Echinochasmus japonicus	Epizootic	Lee et al. 1976
Echinoparyphium dunni	Experimental – death	Kumaran and Peter 1973
Echinoparyphium recurvatum	Pathology, death, epizootic	Betz 1941; Heinemann 1936; Kublitskene and Tsyunene 1973; Shleikus and Tatarintsevaite 1960; Soulsby 1955; Trofimov 1962; Tsyunene 1968; Persson et al. 1974
Echinostoma lindoensis	Experimental – death	Lie 1964*a*, 1964*b*
Echinostoma paraulum	Pathology, death with multiple infection	Heinemann 1936; Supperer 1959; Tsyunene 1968
Echinostoma revolutum	Pathology, epizootic, death	Kingscote 1951; Kublitskene and Tsyunene 1973; Supperer 1959; Tsyunene 1968

Table 1. (cont.)

Parasite	Condition reported	Citation
Hypoderaeum conoideum	Pathology, death with multiple infection	Heinemann 1936; Kublitskene and Tsyunene 1973; Tsyunene 1968; Vevers 1923
Hypoderaeum dingeri	Experimental – death	Lie 1964*a*
Philophthalmus gralli	Pathology	Buša 1956, 1957, 1962, 1963, 1965; Richter et al. 1953
Philophthalmus hegeneri	Experimental – pathology	Penner and Fried 1963
Psilochasmus oxyurus	Pathology	Dubey and Pande 1965
Psilotrema oligoon	Epizootic	Honer 1964; Wertejuk 1958
Psilotrema simillimum	Death with multiple infection, death	Southwell and Kirshner 1937; Endrigkeit 1940
Sphaeridiotrema globulus	Pathology, death, epizootic	Burns 1961; Campbell and Jackson 1977; Cornwell and Cowan 1963; Cornwell et al. 1961; Francalanci and Manfredini 1969; Price 1934; Speckmann et al. 1972; Testi 1962
Zygocotyle lunata	Death	Mettrick 1959
Catatropis verrucosa	Death with multiple infection	Endrigkeit 1940
Notocotylus attenuatus	Death, death with multiple infection, epizootic	Heinemann 1936; Garkavi 1964; Persson et al. 1974; Serafin 1957; Vevers 1920; Wehrmann 1909
Notocotylus babai	Pathology	Dubey and Pande 1965
Notocotylus ephemera	Death with multiple infection	Heinemann 1936
Notocotylus seineti	Death with multiple infection	Heinemann 1936
Paramonostomum alveatum	Epizootic, death with multiple infection	Kulachkova 1954, 1961, 1973; Persson et al. 1974; Tarazona Vilas 1974
Paramonostomum spp.	Death with multiple infection	Garkavi 1966
Renicola somateriae	Epizootic	Kapitonov 1959
Prosthogonimus cuneatus	Death	Szidat 1933
Prosthodendrium sp.	Death	Kocan and Kocan 1972
Maritrema acadiae	Epizootic	Swales 1933
Maritrema subdolum	Pathology	Garkavi 1964; Il'inskaya and Garkavi 1972
Microphallus claviformis	Pathology	Garkavi 1964, 1966; Il'inskaya and Garkavi 1972
Microphallus pygmaeus	Epizootic – multiple infection, pathology	Belopol'skaya 1952; Kulachkova 1973
Microphallus spp.	Death – multiple infection	Persson et al. 1974
Ascocotyle italica	Death	Francalanci 1969*a*
Cryptocotyle concavum	Epizootic	Francalanci 1969*b*
Amphimerus anatis	Death – multiple infection	Mohiuddin and Lone 1967
Amphimerus elongatus	Epizootic	Gower 1938; O'Roke 1935
Metorchis bilis	Death, pathology	Graefner and Graubman 1965; Graefner et al. 1965
Metorchis orientalis	Pathology	Hsü and Hoeppli 1940
Opisthorchis longissimus	Death	Fotedar 1974

CHECKLIST OF TREMATODES

Name and classification	Prevalence	Status of Host (if not wild)
ORDER STRIGEATOIDEA		
Family Cyathocotylidae		
Cyathocotyle bithyniae Sudarikov 1973	Experimental	Domestic
Cyathocotyle bushiensis Khan 1962	Frequent	
Cyathocotyle indica Mehra 1943	Accidental?	
Cyathocotyle melanittae Yamaguti 1934	Rare	
Cyathocotyle opaca (Wisniewski 1934)	Experimental	Domestic
Cyathocotyle prussica Muhling 1896	Frequent	Wild, domestic
Cyathocotyle skrjabini Petrov and Sudarikov 1963	Rare	Domestic
Holostephanus cobitidis Opravilova 1968	Experimental	Domestic
Holostephanus curonensis (Szidat 1933)	Rare	Wild, domestic
Holostephanus dubius (Szidat 1936)	Experimental	Domestic
Holostephanus luehei Szidat 1936	Experimental	Domestic
Holostephanus lutzi (Faust and Tang 1938)	Rare	Domestic
Holostephanus volgensis (Sudarikov 1962)	Experimental	Domestic
Paracoenogonimus ovatus Katsurada 1914	Accidental?	
Paracoenogonimus viviparae (Linstow 1877)	Rare	
Mesostephanus sp. Richard 1965	Accidental	
Family Diplostomatidae		
Alaria alata (Goeze 1782) (larva)	Experimental	Domestic
Alaria canis LaRue and Fallis 1936 (larva)	Experimental	Domestic
Diplostomum gasterostei Williams 1966	Experimental	Domestic
Diplostomum gavium (Guberlet 1922)	Accidental	
Diplostomum gobiorum Shigin 1965	Experimental	Domestic
Diplostomum mergi mergi Dubois 1932	Frequent	
Diplostomum mergi alascense Dubois 1969	Rare	
Diplostomum micradenum (Cort and Brackett 1939)	Experimental	Domestic
Diplostomum parviventosum Dubois 1932	Infrequent	
Diplostomum phoxini (Faust 1918)	Rare	
Diplostomum pusillum (Dubois 1927)	Infrequent	
Diplostomum scudderi (Olivier 1941)	Rare	
Diplostomum spathaceum spathaceum (Rudolphi 1819)	Accidental	
Diplostomum spathaceum indistinctum (Guberlet 1923) (larva)	Accidental	
Neodiplostomum attenuatum (Linstow 1906) (larva)	Experimental	Domestic
Neodiplostomum canaliculatum (Nicoll 1914) (larva)	Experimental	Domestic
Neodiplostomum spathoides Dubois 1937 (larva)	Experimental	Domestic
Neodiplostomum spathula (Creplin 1829)	Accidental	
Ornithodiplostomum ptychocheilus (Faust 1917)	Infrequent	
Ornithodiplostomum scardinii (Shul'man 1952)	Infrequent	
Pharyngostomum cordatum (Diesing 1850) (larva)	Experimental	Domestic
Posthodiplostomum minimum (MacCallum 1921)	Experimental	Domestic
Tylodelphys clavata (Nordmann 1832)	Accidental	
Tylodelphys lucknowensis Pandey 1973	Rare	
Uvulifer denticulatus (Rudolphi 1819)	Experimental	Domestic

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Family Strigeidae		
Apatemon anseris Dubois 1967	Infrequent	
Apatemon bdellocystis Lutz 1933	Rare	Wild, domestic
Apatemon burti (Miller 1923)	Frequent?	
Apatemon canadensis (Dubois and Rausch 1950)	Infrequent	
Apatemon congolensis (Dubois and Fain 1956)	Rare	
Apatemon fuhrmanni Dubois 1937	Infrequent	
Apatemon fuligulae Yamaguti 1933	Frequent	
Apatemon graciliformis Szidat 1928	Rare	
Apatemon gracilis (Rudolphi 1819)	Infrequent	
Apatemon indicus Vidyarthi 1937	Rare	
Apatemon intermedius (Johnston 1904)	Infrequent	
Apatemon japonicus Ishii 1932	Rare	Wild, domestic
Apatemon minor Yamaguti 1933	Frequent	Wild, domestic
Apatemon parvitestis Ishii 1935	Rare	
Apatemon somateriae somateriae Dubois 1948	Rare	
Apatemon somateriae fischeri Dubois 1968	Rare	
Apatemon vitelliresiduus Dubois and Angel 1972	Rare	
Cotylurus brevis Dubois and Rausch 1948	Infrequent	
Cotylurus cornutus (Rudolphi 1808)	Frequent	Wild, domestic
Cotylurus erraticus (Rudolphi 1809)	Accidental	
Cotylurus flabelliformis (Faust 1917)	Frequent	Wild, domestic
Cotylurus gallinulae hebraicus Dubois 1934	Accidental	Wild, domestic
Cotylurus japonicus Ishii 1932	Infrequent	Wild, domestic
Cotylurus magniacetabulus Dubois and Angel 1972	Rare	
Cotylurus pileatus (Rudolphi 1802)	Accidental	Wild, domestic
Cotylurus platycephalus (Creplin 1825)	Accidental	
Cotylurus raabei (Bezubik 1958)	Infrequent	Wild, domestic
Cotylurus strigeoides Dubois 1958	Frequent	
Cotylurus syrius Dubois 1934	Rare	Wild, domestic
Parastrigea robusta Szidat 1928	Infrequent	Wild, domestic
Pseudapatemon mamilliformis (Tubangui 1932)	Accidental	Domestic
Strigea elegans Chandler and Rausch 1947 (larva)	Experimental	Domestic
Strigea falconis Szidat 1928 (larva)	Frequent	
Strigea vaginata (Brandes 1888) (larva)	Experimental	Domestic
Family Schistosomatidae		
Austrobilharzia pricei (Wetzel 1930)	Rare	
Austrobilharzia terrigalensis Johnston 1917	Infrequent	
Bilharziella indica (Lal 1937)	Rare	
Bilharziella polonica (Kowalewski 1895)	Characteristic	Wild, domestic
Dendritobilharziella asiaticus Mehra 1940	Rare	Wild, domestic
Dendritobilharziella pulverulenta (Braun 1901)	Common	Wild, domestic
Gigantobilharzia acotylea Odhner 1910	Accidental?	
Gigantobilharzia adami Fain 1960	Rare	
Gigantobilharzia mazuriana Khalifa 1974	Experimental	Domestic
Gigantobilharzia monocotylea Szidat 1930	Rare	
Gigantobilharzia nettapi Fain 1960	Rare	
Gigantobilharzia plectropteri Fain 1960	Rare	

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Gigantobilharzia vittensis Reimer 1963	Experimental	Domestic
Jilinobilharzia crecci Liu and Bai 1976	Rare	
Jilinobilharzia yokogawai (Oiso 1927)	Infrequent	Wild, domestic
Trichobilharzia adamsi Edwards and Jansch 1955	Experimental	Domestic
Trichobilharzia alaskensis Harkema 1960	Experimental	Domestic
Trichobilharzia anatina Fain 1955	Rare	
Trichobilharzia brantae Farr and Blankemeyer 1956	Infrequent	
Trichobilharzia brevis Basch 1966	Rare	Domestic
Trichobilharzia burnetti (Brackett 1942)	Rare	
Trichobilharzia cameroni Wu 1953	Experimental	Domestic
Trichobilharzia duboisi Fain 1959	Rare	
Trichobilharzia elvae (Miller 1923)	Experimental	Domestic
Trichobilharzia filiformis (Szidat 1938)	Infrequent	
Trichobilharzia horiconensis (Brackett 1942)	Rare	
Trichobilharzia indica Baugh 1963	Rare	
Trichobilharzia jianensis Liu et al. 1977	Rare	Domestic
Trichobilharzia kegonsensis (Brackett 1942)	Rare	
Trichobilharzia kossarewi Skrjabin and Zacharow 1920	Rare	
Trichobilharzia kowalewskii (Ejsmont 1929)	Infrequent	
Trichobilharzia nasicola Fain 1955	Rare	
Trichobilharzia ocellata (La Valette 1855)	Frequent	Wild, domestic
Trichobilharzia oregonensis (MacFarlane and Macy 1946)	Experimental	Domestic
Trichobilharzia paoi	Rare	Domestic
Trichobilharzia physellae (Talbot 1936)	Infrequent	Wild, domestic
Trichobilharzia querquedulae (McLeod 1937)	Infrequent	
Trichobilharzia rodhaini Fain 1955	Rare	Domestic
Trichobilharzia schoutedeni Fain 1955	Rare	
Trichobilharzia spinulata Fain 1955	Rare	
Trichobilharzia stagnicolae (Talbot 1936)	Experimental	Domestic
Trichobilharzia szidati Neuhaus 1952	Rare	Wild, domestic
Trichobilharzia waubesensis (Brackett 1942)	Rare	
Cercaria longicauda Macfarlane 1949	Experimental	Domestic
Cercaria mieensis Ishida 1960	Rare	
Family Cyclocoeliidae		
Cyclocoelum brasilianum Stossich 1902	Accidental	
Cyclocoelum mutabile (Zeder 1800)	Accidental	
Cyclocoelum obscurum (Leidy 1887)	Accidental	
Cyclocoelum odeningi Dubois 1965	Infrequent	Captive
Cyclocoelum tringae (Brandes 1892)	Accidental	
Cyclocoelum vanelli (Rudolphi 1819)	Accidental	
Hyptiasmus arcuatus (Brandes 1892)	Common	Wild, domestic
Hyptiasmus oculeus Kossack 1911	Accidental	
Hyptiasmus vigisi Savinov 1960	Rare	
Hyptiasmus witenbergi Tret'yakova 1950	Rare	
Prohyptiasmus robustus (Stossich 1902)	Frequent	Wild, domestic
Ophthalmophagus magalhaesi Travassos 1921	Infrequent	Wild, domestic
Ophthalmophagus singularis Stossich 1902	Accidental	
Ophthalmophagus variolaris (Fuhrmann 1904)	Accidental?	
Neivaia cymbium (Diesing 1850)	Rare	
Typhlocoelum cucumerinum (Rudolphi 1809)	Characteristic	Wild, domestic

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Typhlocoelum indicum Fotedar 1965	Rare	
Typhlocoelum sisowi sisowi (Skrjabin 1913)	Characteristic	Wild, domestic
Typhlocoelum sisowi acirratus (Jain 1966)	Rare	
Family Orchipedidae		
Orchipedum tracheicola Braun 1901	Frequent	
Family Brachylaemidae		
Amblosoma exile Pojmanska 1972	Rare	
Brachylaemus fuscatum (Rudolphi 1819)	Accidental	
Leucochloridiomorpha clangula Zinov'ev 1969	Rare	
Leucochloridiomorpha constantiae (Mueller 1935)	Infrequent	
Leucochloridiomorpha lutea (Baer 1927)	Rare	
Leucochloridiomorpha papillata Shoemaker 1961	Experimental	Domestic
Family Leucochloridiidae		
Leucochloridium cyanocittae McIntosh 1932	Accidental	
Leucochloridium flavum Travassos 1922	Accidental	
Leucochloridium insigne (Looss 1896)	Accidental	
Family Fellodistomatidae		
Gymnophallus bilis Brinkmann 1956	Rare	
Gymnophallus bursicola Odhner 1900	Infrequent	
Gymnophallus choledocus Odhner 1900	Frequent	
Gymnophallus deliciosus (Olsson 1893)	Infrequent	
Gymnophallus gibberosus Loos-Frank 1971	Rare	
Gymnophallus mollissima (Morozov 1960)	Rare	
Gymnophallus nereicola Rébecq and Prévot 1962	Experimental	Domestic
Gymnophallus rostratus Bartoli 1974	Infrequent	
Gymnophallus skrjabini Ryzhikov 1963	Rare	
Gymnophallus somateriae (Levinsen 1881)	Infrequent	
Lacunovermis ceratostomus (Tsimbalyuk and Leonov 1963)	Rare	
Lacunovermis conspicuus Ching 1965	Rare	
Lacunovermis macomae (Lebour 1908)	Infrequent	
Lacunovermis macrostomus (Yamaguti 1939)	Infrequent	
Meiogymnophallus jamesoni Bowers 1966	Rare	
Meiogymnophallus minor Ryzhikov 1963	Rare	
Meiogymnophallus minutus (Cobbold 1859)	Infrequent	
Meiogymnophallus multigemmulus Ching 1965	Rare	
Paragymnophallus odhneri Ching 1973	Infrequent	
Parvatrema affine (Jameson and Nicoll 1913)	Infrequent	
Parvatrema borealis Stunkard and Uzmann 1958	Experimental	Captive
Parvatrema lintoni James 1964	Rare	
Parvatrema ovoplenus (Jameson and Nicoll 1913)	Rare	
Parvatrema timondavidi Bartoli 1963	Experimental	Domestic

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
ORDER ECHINOSTOMIDA		
Family Cathaemasiidae		
Guaicaipuria parapseudoconcilia Nasir and Silva 1972	Experimental	Domestic
Ribeiroia ondatrae (Price 1931)	Accidental?	Wild, domestic
Family Echinostomatidae		
Acanthoparyphium kurogamo Yamaguti 1939	Rare	
Acanthoparyphium marilae Yamaguti 1934	Rare	
Acanthoparyphium melanittae Yamaguti 1939	Rare	
Acanthoparyphium parácharadrii Velasquez 1964	Experimental	Domestic
Acanthoparyphium spinulosum Johnston 1917	Accidental?	
Aporchis croaticus (Stossich 1889)	Rare	
Cotylotretus cubanicus Artyukh 1958	Rare	Wild, domestic
Cotylotretus grandis (Rudolphi 1819)	Rare	
Curtuteria grummti Odening 1963	Rare	Wild, captive
Curtuteria numenii Reimer 1963	Accidental	
Echinochasmus amphibolus Kotlan 1922	Accidental	
Echinochasmus beleocephalus (Linstow 1873)	Frequent	Wild, domestic
Echinochasmus coaxatus Dietz 1909	Accidental?	
Echinochasmus dietzevi Isaĭchikov 1927	Accidental?	
Echinochasmus japonicus Tanabe 1926	Accidental?	Wild, domestic
Echinochasmus japonicus west-sibiricus Filimonova 1974	Experimental	Domestic
Echinochasmus mergi mergi (Cannon 1938)	Rare	
Echinochasmus mergi palaearcticus Odening 1963	Rare	Captive
Echinochasmus milvi Yamaguti 1939	Experimental	Domestic
Echinochasmus mirus Mendheim 1940	Rare	
Echinochasmus mordax (Looss 1899)	Accidental?	
Echinoparyphium aconiatum Dietz 1909	Common	Wild, domestic
Echinoparyphium anatis Fischthal and Kuntz 1976	Rare	Domestic
Echinoparyphium aquaticum Bashkirova 1941	Rare	
Echinoparyphium baculus (Diesing 1850)	Frequent	Wild, domestic
Echinoparyphium bagulai Jain 1961	Rare	Captive
Echinoparyphium bioccalerouxi Dollfus 1953	Experimental	Domestic
Echinoparyphium chinensis Ku, Li, and Chu 1964	Rare	Domestic
Echinoparyphium clerci Skrjabin 1915	Accidental?	Wild, domestic
Echinoparyphium dunni Lie and Umathevy 1965	Experimental	Domestic
Echinoparyphium elegans (Looss 1899)	Rare	
Echinoparyphium ellisi (Johnston and Simpson 1944)	Rare	
Echinoparyphium flexum (Linton 1892)	Infrequent	
Echinoparyphium gizzardai Verma 1936	Rare	Captive
Echinoparyphium longicirrus (Verma 1936)	Rare	Captive
Echinoparyphium minor (Hsü 1935)	Rare	Domestic
Echinoparyphium mordwilkoi Skrjabin 1915	Accidental	
Echinoparyphium nordiana Bashkirova 1941	Infrequent	Wild, domestic
Echinoparyphium paracinctum Bykhovskaya 1954	Rare	Wild, domestic
Echinoparyphium politus Skrjabin 1915	Accidental?	
Echinoparyphium querquedulae Ablasov and Chibichenko 1960	Rare	
Echinoparyphium ralphaudyi Lie et al. 1975	Experimental	Domestic

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Echinoparyphium recurvatum (Linstow 1873)	Characteristic	Wild, domestic
Echinoparyphium serratum Howell 1968	Experimental	Domestic
Echinoparyphium sinorchis Oshmarin 1956	Rare	
Echinoparyphium spiniferum (La Valette 1855)	Experimental	Domestic
Echinoparyphium syrdariense Burdelev 1937	Rare	
Echinoparyphium westsibiricum Isaĭchikov 1925	Infrequent	Wild, domestic
Echinostoma amurzetica Petrochenko and Egorova 1961	Rare	Domestic
Echinostoma anseris Yamaguti 1939	Infrequent	Wild, domestic
Echinostoma asiatica Mendheim 1943	Rare	Domestic
Echinostoma audyi Lie and Umathevy 1965	Experimental	Domestic
Echinostoma barbosai Lie and Basch 1966	Experimental	Domestic
Echinostoma bhattacharyai indicus Ablasov and Chibichenko 1960	Rare	
Echinostoma chasma Lal 1939	Rare	
Echinostoma chloropodis (Zeder 1800)	Accidental	
Echinostoma crecci Verma 1936	Rare	
Echinostoma dietzi Skrjabin 1924	Infrequent	Wild, domestic
Echinostoma fulicae Porter 1921	Experimental	Domestic
Echinostoma gotoi Ando and Ozaki 1923	Rare	
Echinostoma grandis Bashkirova 1946	Accidental	Wild, domestic
Echinostoma hortense Asada 1926	Experimental?	Domestic
Echinostoma katsuradai Kurisu 1930	Experimental	Domestic
Echinostoma koisarensis Ablasov and Iksanov 1959	Rare	
Echinostoma liei Jeyarasasingam et al. 1972	Experimental	Domestic
Echinostoma lindoensis Sandground and Bonne 1940	Rare	Domestic
Echinostoma minimus Verma 1936	Rare	Captive
Echinostoma miyagawai Ishii 1932	Common	Wild, domestic
Echinostoma novum (Verma 1936)	Infrequent	Wild, domestic
Echinostoma paraulum Dietz 1909	Common	Wild, domestic
Echinostoma pekinensis Ku 1937	Rare	Domestic
Echinostoma revolutum (Froelich 1802)	Characteristic	Wild, domestic
Echinostoma robustum Yamaguti 1935	Common	Wild, domestic
Echinostoma rufinae Kurova 1927	Infrequent	
Echinostoma sarcinum Dietz 1909	Accidental	
Echinostoma stromi Bashkirova 1946	Infrequent	Wild, domestic
Echinostoma sudanense Odhner 1910	Accidental	
Echinostoma turkestanicum Kurova 1927	Infrequent	
Episthmium colymbi (Shigin 1956)	Accidental	
Euparyphium murinum Tubangui 1931	Rare	Domestic
Euparyphium sobolevi Ryzhikov 1965	Rare	
Himasthla compacta Stunkard 1960	Rare	
Himasthla elongata (Mehlis 1831)	Accidental	
Himasthla incisa Linton 1928	Rare	
Himasthla leptosoma (Creplin 1829)	Rare	
Himasthla militaris (Rudolphi 1803)	Accidental	
Hypoderaeum conoideum (Bloch 1782)	Characteristic	Wild, domestic
Hypoderaeum dingeri Lie 1964	Experimental	Domestic
Hypoderaeum gnedini Bashkirova 1941	Infrequent	Wild, domestic
Hypoderaeum indica Gupta and Jahan 1976	Rare	
Hypoderaeum mainpuria Verma 1936	Rare	
Hypoderaeum microspina (Singh 1954)	Rare	
Hypoderaeum skrjabini Oshmarin 1956	Infrequent	
Hypoderaeum sobolevi Alekseev 1965	Rare	

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Hypoderaeum vigi Bashkirova 1941	Infrequent	Wild, domestic
Metechinostoma amurensis Petrochenko and Khrustaleva 1963	Rare	Domestic
Moliniella anceps (Molin 1859)	Accidental	
Neoacanthoparyphium echinatoides (Filippi 1854)	Rare	Domestic
Parechinostomum cinctum (Rudolphi 1803)	Frequent	Wild, domestic
Paryphostomum horai Baugh 1950	Rare	
Paryphostomum pentalobum Verma 1936	Accidental?	Domestic
Paryphostomum radiatum (Dujardin 1845)	Accidental?	Domestic
Paryphostomum testitrifolium Gogate 1934	Accidental?	
Patagifer bilobus (Rudolphi 1819)	Accidental	
Pegosomum ixobrychi Gvozdev 1960	Accidental?	Domestic
Petasiger coronatus Mendheim 1940	Rare	
Petasiger grandevesicularis Ishii 1935	Accidental	
Petasiger jubilarum (El'perin 1937)	Rare	
Petasiger longicirratus Ku 1938	Rare	
Petasiger megacanthum (Kotlan 1922)	Accidental	
Petasiger minutissimus Gogate 1934	Rare	
Petasiger skrjabini Bashkirova 1941	Rare	
Protechinostoma mucronisertulatum Beaver 1943	Experimental	Domestic
Stephanoprora denticulata (Rudolphi 1802)	Accidental?	
Stephanoprora gracilis Mendheim 1940	Rare	
Stephanoprora paradenticulata Nasir and Rodriguez 1969	Experimental	Domestic
Stephanoprora pseudodenticulata Mendheim 1940	Rare	
Stephanoprora pseudoechinata (Olsson 1876)	Infrequent	
Stephanoprora spinulosa (Odhner 1910)	Accidental?	
Vermatrema longitestis (Verma 1936)	Rare	Captive
Family Philophthalmidae		
Cloacitrema ovatum Yamaguti 1935	Infrequent	
Cloacitrema philippinum Velasquez 1969	Experimental	Domestic
Parorchis acanthus (Nicoll 1907)	Experimental	Domestic
Philophthalmus anatinus Sugimoto 1928	Infrequent	Domestic
Philophthalmus gralli Mathis and Leger 1910	Infrequent	Wild, domestic
Philophthalmus hegeneri Penner and Fried 1963	Experimental	Domestic
Philophthalmus muraschkinzewi Tret'yakova 1948	Rare	Domestic
Philophthalmus nocturnus Looss 1907	Rare	
Philophthalmus nyrocae Yamaguti 1934	Infrequent	
Philophthalmus proboscidus Oshmarin 1963	Rare	
Philophthalmus rizalensis Tubangui 1932	Rare	Domestic
Philophthalmus sinensis Hsü and Chow 1938	Rare	Domestic
Philophthalmus skrjabini Efimov 1937	Rare	
Family Psilostomatidae		
Pseudopsilostoma varium (Linton 1928)	Accidental?	
Psilochasmus alii Jaiswal 1957	Rare	
Psilochasmus indicus Gupta 1957	Rare	
Psilochasmus longicirratus Skrjabin 1913	Common	Wild, domestic
Psilochasmus oxyurus (Creplin 1825)	Characteristic	Wild, domestic
Psilochasmus singhi Jaiswal and Humayon 1971	Rare	

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Psilochasmus skrjabini Gnedina 1946	Infrequent	Wild, domestic
Psilochasmus sphincteropharynx Oshmarin 1970	Rare	Domestic
Psilorchis ajgainis Lal 1938	Rare	
Psilorchis seekhpari Jain 1967	Rare	
Psilorchis udaipurensis Sharma 1977	Rare	
Psilostomum anserinum Oshmarin 1963	Rare	
Psilostomum borealis Ryzhikov 1963	Rare	
Psilostomum brevicolle (Creplin 1829)	Infrequent	Wild, captive
Psilostomum marilae Price 1942	Rare	
Psilotrema acutirostris Oshmarin 1963	Infrequent	
Psilotrema brevis Oshmarin 1963	Infrequent	
Psilotrema creccai Gupta and Jahan 1977	Rare	
Psilotrema mediopora Oshmarin 1963	Infrequent	
Psilotrema nettapusi Gupta and Gupta 1977	Rare	
Psilotrema oligoon (Linstow 1887)	Common	Wild, domestic
Psilotrema simillimum simillimum (Muehling 1898)	Common	Wild, domestic
Psilotrema simillimum swerinensis Graefner 1965	Rare	Domestic
Sharmaia gatesi (Sharma 1943)	Rare	Domestic
Sphaeridiotrema globulus (Rudolphi 1814)	Frequent	Wild, domestic
Family Paramphistomatidae		
Zygocotyle lunata (Diesing 1850)	Characteristic	Wild, domestic
Family Notocotylidae		
Catatropis appendiculata Lutz 1928	Rare	
Catatropis cygni Yamaguti 1939	Rare	
Catatropis harwoodi Bullock 1952	Rare	
Catatropis hisikui Yamaguti 1939	Rare	
Catatropis indicus Srivastava 1935	Rare	Domestic
Catatropis orientalis Harshe 1932	Rare	
Catatropis pricei Harwood 1939	Rare	
Catatropis rauschi Singh 1956	Rare	
Catatropis verrucosa (Froelich 1789)	Characteristic	Wild, domestic
Notocotylus aegyptiacus Odhner 1905	Infrequent	Domestic
Notocotylus anseri Gupta and Gupta 1976	Rare	
Notocotylus atlanticus Stunkard 1966	Experimental	Captive
Notocotylus attenuatus (Rudolphi 1809)	Characteristic	Wild, domestic
Notocotylus babai Bhalerao 1935	Infrequent	Wild, domestic
Notocotylus breviserialis (Stunkard 1967)	Experimental	Domestic
Notocotylus dafilae Harwood 1939	Infrequent	
Notocotylus duboisianus Odening 1964	Rare	Captive
Notocotylus ephemera (Nitzsch 1807)	Infrequent	Wild, domestic
Notocotylus gibbus (Mehlis 1846)	Accidental	
Notocotylus gippyensis (Beverley-Burton 1958)	Rare	
Notocotylus imbricatus imbricatus (Looss 1893)	Frequent	Wild, domestic
Notocotylus imbricatus magniovatus (Yamaguti 1934)	Infrequent	
Notocotylus kanpurensis Gupta and Gupta 1977	Rare	
Notocotylus linearis (Rudolphi 1819)	Accidental	
Notocotylus mamii Hsü 1954	Rare	

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Notocotylus minutus Stunkard 1960	Infrequent	Wild, domestic
Notocotylus naviformis Tubangui 1932	Rare	Domestic
Notocotylus pacifera (Noble 1933)	Accidental	
Notocotylus parviovatus Yamaguti 1934	Common	Wild, domestic
Notocotylus ralli Baylis 1936	Experimental	Domestic
Notocotylus seineti Fuhrmann 1919	Infrequent	Wild, domestic
Notocotylus skrjabini Ablasov 1953	Infrequent	
Notocotylus stagnicolae Herber 1942	Rare	
Notocotylus tachyeretis Duthoit 1931	Rare	
Notocotylus tadornae Bisset 1977	Infrequent?	
Notocotylus urbanensis Cort 1914	Rare	
Notocotylus zduni Chiaberashvili and Dzavelidze 1968	Experimental	Domestic
Paramonostomum alveatum (Mehlis 1846)	Common	Wild, domestic
Paramonostomum alveoelongatum Filimonova 1971	Rare	
Paramonostomum anatis Garkavi 1965	Rare	Domestic
Paramonostomum bucephalae Yamaguti 1935	Infrequent	Wild, domestic
Paramonostomum bychowskoi-pawlowskoi Sailov 1962	Rare	
Paramonostomum casarcum Lal 1936	Rare	
Paramonostomum chabaudi van Strydonck 1965	Rare	
Paramonostomum elongatum Yamaguti 1934	Infrequent	
Paramonostomum harwoodi Nath and Pande 1962	Rare	
Paramonostomum histrionici Ching 1961	Rare	
Paramonostomum malerischi Dunagan 1957	Rare	
Paramonostomum nettioni Baugh 1958	Rare	
Paramonostomum ovatus Hsü 1935	Rare	Wild, domestic
Paramonostomum parvum Stunkard and Dunihue 1931	Infrequent	
Paramonostomum philippinensis Velasquez 1969	Experimental	Domestic
Paramonostomum pseudalveatum Price 1931	Infrequent	Wild, domestic
Paramonostomum querquedulum Lal 1953	Rare	
Parapronocephalum symmetricum Belopol'skaya 1952	Accidental	
Tristriata anatis Belopol'skaya 1953	Infrequent	
Tristriata elegans Filimonova 1971	Rare	
ORDER RENICOLIDA		
Family Renicolidae		
Renicola brantae McIntosh and Farr 1952	Rare	
Renicola keimahuri Yamaguti 1939	Accidental	
Renicola lari Timon-David 1933	Accidental	
Renicola mediovitellata Bykhovskaya 1950	Infrequent	
Renicola mollissima Kulachkova 1957	Infrequent	
Renicola somateriae Belopol'skaya 1952	Infrequent	
Renicola umigarasu Yamaguti 1939	Accidental	
ORDER PLAGIORCHIIDA		
Family Collyriclidae		
Collyriclum faba (Bremser 1831)	Accidental	Domestic

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Family Dicrocoeliidae		
Athesmia rudectum (Braun 1901)	Rare	
Brachylecithum longibursatum Panin 1973	Rare	
Brachylecithum sp. Gvozdev 1962	Accidental?	
Corrigia obscura Daniels and Freeman 1976	Rare	
Lyperosomum anatis Belogurov and Leonov 1963	Rare	
Pancreatrema sp. Lalitha and Alwar 1960	Rare	Domestic
Proacetabulorchoides anatis Oshmarin 1970	Rare	Domestic
Wetzelitrema melanitae Rayski and Fahmy 1962	Rare	
Family Eucotylidae		
Eucotyle baiyangdienensis Lee, Tso, and Ku 1973	Rare	
Eucotyle castanea Jensen 1971	Rare	
Eucotyle cohni Skrjabin 1924	Infrequent	
Eucotyle freitasi Costa and Freitas 1972	Rare	Domestic
Eucotyle nephritica (Mehlis 1846)	Rare	
Eucotyle popowi Skrjabin and Evranova 1942	Infrequent	Wild, domestic
Eucotyle warreni Schell 1967	Rare	
Eucotyle wehri Price 1930	Infrequent	
Eucotyle zakharowi Skrjabin 1920	Common	Wild, domestic
Tanaisia fedtschenkoi fedtschenkoi Skrjabin 1924	Accidental	
Tanaisia fedtschenkoi meridionalis Odening 1964	Rare	Captive
Tanaisia (Tamerlania) sp. Kamburov and Vasilev 1972	Accidental?	
Family Haplometridae		
Cylindrotrema cygni Angel 1973	Rare	
Prosthogonimus cuneatus (Rudolphi 1809)	Common	Wild, domestic
Prosthogonimus macrorchis Macy 1934	Infrequent	Wild, domestic
Prosthogonimus ovatus (Rudolphi 1803)	Characteristic	Wild, domestic
Prosthogonimus spinatus Shevtsov 1965	Rare	Domestic
Prosthogonimus ventroporus Oshmarin 1970	Rare	Domestic
Schistogonimus rarus (Braun 1901)	Common	Wild, domestic
Family Lecithodendriidae		
Pleuropsolus somateriae Morozov 1960	Rare	
Prosthodendrium sp. Kocan and Kocan 1972	Accidental	
Family Microphallidae		
Anacetabulitrema samarae Deblock and Rosé 1964	Rare	
Ascorhytis charadriformis (Young 1949)	Rare	
Atriophallophorus minutus (Price 1934)	Infrequent	Wild, domestic
Basantisia tamsuiensis (Chiu 1961)	Experimental	Domestic
Levinseniella amnicolae Etges 1953	Rare	Domestic
Levinseniella brachysoma (Creplin 1837)	Infrequent	
Levinseniella bucephalae (Yamaguti 1935)	Infrequent	

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Levinseniella camtshatica Morozov 1960	Rare	
Levinseniella cruzi Travassos 1921	Rare	
Levinseniella cryptacetabula Oshmarin 1970	Rare	Domestic
Levinseniella pellucida Jaegerskioeld 1907	Infrequent	Wild, domestic
Levinseniella propinqua Jaegerskioeld 1907	Infrequent	
Levinseniella sp. Deblock and Pearson 1970	Rare	
Maritrema acadiae (Swales 1933)	Rare	
Maritrema afanassjewi afanassjewi Belopol'skaya 1952	Accidental?	
Maritrema afanassjewi minor Chen 1957	Rare	Domestic
Maritrema calvertensis Smith 1974	Rare	
Maritrema gratiosum Nicoll 1907	Accidental	
Maritrema inusitata Leonov and Tsimbalyuk 1973	Rare	
Maritrema japonicum (Yamaguti 1939)	Infrequent	
Maritrema macracetabulum Deblock and Rosé 1964	Rare	
Maritrema megametrios Deblock and Rausch 1968	Rare	
Maritrema nicolli Travassos 1921	Rare	
Maritrema obstipum (Van Cleave and Mueller 1952)	Rare	Wild, domestic
Maritrema paracadiae Ching 1974	Rare	
Maritrema subdolum Jaegerskioeld 1908	Frequent	Wild, domestic
Microphallus claviformis (Brandes 1888)	Accidental	Wild, domestic
Microphallus hoffmani Rébecq 1964	Experimental	Domestic
Microphallus longicaecus Chen 1956	Rare	Domestic
Microphallus nicolli (Cable and Hunninen 1938)	Accidental?	
Microphallus oblonga Ching 1965	Accidental?	
Microphallus papillorobustus (Rankin 1940)	Accidental	Wild, domestic
Microphallus pirum (Afanas'ev 1941)	Accidental	
Microphallus primas (Jaegerskioeld 1908)	Accidental?	
Microphallus pseudogonotylus (Chen 1944)	Rare	Domestic
Microphallus pygmaeus (Levinsen 1881)	Common	
Microphallus similis (Jaegerskioeld 1900)	Accidental	
Microphallus somateriae (Kulachkova 1958)	Infrequent	
Microphallus tasmaniae Smith 1974	Rare	
Microphallus tauricus Sten'ko 1973	Experimental	Domestic
Odhneria odhneri Travassos 1921	Accidental	
Odhneria raminellae (Dery 1958)	Rare	
Pseudolevinseniella cheni Tsai 1955	Experimental	Domestic
Pseudospelotrema sp. Deblock 1972	Rare	
Quasimaritrema caridinae (Yamaguti and Nisimura 1944)	Accidental	Domestic
Spiculotrema litoralis Belopol'skaya 1949	Accidental	
Family Plagiorchiidae		
Plagiorchis elegans (Rudolphi 1802)	Accidental	Wild, domestic
Plagiorchis fastuosus Szidat 1924	Rare	
Plagiorchis maculosus (Rudolphi 1802)	Accidental	
Plagiorchis nanus (Rudolphi 1802)	Accidental	
Plagiorchis nyrocae Ryzhikov and Timofeeva 1962	Rare	
Family Stomylotrematidae		
Lecithodollfusia anatina Khotenovskii 1967	Rare	

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Family Troglotrematidae		
Nanophyetus salmincola (Chapin 1926)	Accidental?	
ORDER OPISTHORCHIIDA		
Family Heterophyidae		
Apophallus bacalloti Morozov 1952	Experimental	Domestic
Apophallus donicus (Skrjabin and Lindtrop 1919)	Accidental?	
Ascocotyle angrense Travassos 1916	Accidental	
Ascocotyle italica Alessandrini 1906	Accidental?	Domestic
Centrocestus formosanus (Nishigori 1924)	Experimental	Domestic
Cryptocotyle concavum (Creplin 1825)	Frequent	Wild, domestic
Cryptocotyle cryptocotyloides (Isaĭchikov 1923)	Accidental?	
Cryptocotyle jejuna (Nicoll 1907)	Accidental	
Cryptocotyle lingua (Creplin 1825)	Accidental?	
Galactosoma baylisi (Gohar 1930)	Accidental?	Domestic
Haplorchis pumilio (Looss 1896)	Experimental	Domestic
Haplorchis taichui (Nishigori 1924)	Experimental	Domestic
Heterophyopsis expectans (Africa and Garcia 1935)	Rare	
Jubilarium skrjabini Morozov 1959	Rare	
Procerovum calderoni (Africa and Garcia 1935)	Experimental	Domestic
Procerovum cheni Hsü 1950	Experimental	Domestic
Procerovum varium Onji and Nishio 1916	Accidental	Domestic
Procerovum sp. Pearson 1964	Accidental	
Pygidiopsis genata Looss 1907	Accidental	Domestic
Sonkulitrema kazachstanica Zhatkanbaeva 1964	Accidental?	
Stictodora japonica Yamaguti 1939	Rare	
Stictodora mergi Yamaguti 1939	Rare	
Stictodora sawakinensis Looss 1899	Accidental	
Family Opisthorchiidae		
Amphimerus anatis (Yamaguti 1933)	Common	Wild, domestic
Amphimerus elongatus Gower 1938	Infrequent	
Amphimerus lintoni Gower 1939	Infrequent	
Euamphimerus cygnoides Ogata 1942	Rare	
Clonorchis sinensis (Cobbold 1875)	Accidental	Domestic
Metorchis bilis (Braun 1790)	Infrequent	Wild, domestic
Metorchis elegans Belogurov and Leonov 1963	Rare	
Metorchis hovorkai Macko 1955	Rare	
Metorchis nettioni Baugh 1958	Rare	
Metorchis orientalis Tanabe 1920	Frequent	Wild, domestic
Metorchis taiwanensis Morishita and Tsuchimochi 1925	Infrequent	Domestic
Metorchis tener Kowalewski 1903	Rare	
Metorchis xanthosomus (Creplin 1846)	Common	Wild, domestic
Metorchis zacharovi Layman 1926	Rare	
Opisthorchis choledocha (Linstow 1883)	Rare	
Opisthorchis geminus (Looss 1896)	Infrequent	
Opisthorchis longissimus (Linstow 1883)	Accidental?	Wild, domestic

Checklist of Trematodes (cont.)

Name and Classification	Prevalence	Status of Host (if not wild)
Opisthorchis obsequens Nicoll 1914	Infrequent	Wild, domestic
Opisthorchis parageminus Oshmarin 1970	Rare	Domestic
Opisthorchis simulans (Looss 1896)	Common	Wild, domestic
Opisthorchis skrjabini Zhukova 1934	Rare	Domestic
Pachytrema calculus Looss 1907	Accidental	

ANATOMICAL HABITAT

Structure of the Head

Eye – Conjunctival Sac: *Philophthalmus*
Nasal Cavities: *Cyclocoelum*, *Hyptiasmus*, *Ophthalmophagus*, *Typhlocoelum*
Veins of Nasal Fossae: *Trichobilharzia duboisi*, *Trichobilharzia nasicola*, *Trichobilharzia rodhaini*, *Trichobilharzia spinulata*
Nasal Sinus: *Ophthalmophagus*
Suborbital Sinus: *Cyclocoelum*, *Hyptiasmus*, *Ophthalmophagus*, *Typhlocoelum*
Infraorbital Cavity: *Ophthalmophagus*

Parts of the Trunk

Muscles: larvae of *Strigea falconis (Tetracotyle ardeae)*, experimental infections of larvae of several strigeids
Subdermal Tissue of Abdomen: *Collyriclum*

Respiratory System

Trachea: *Hyptiasmus*, *Neivaia*, *Typhlocoelum*, *Orchipedum*
Lungs: *Bilharziella*, *Trichobilharzia*, *Typhlocoelum*
Air Sacs: *Cyclocoelum*, *Prohyptiasmus*, *Typhlocoelum*

Circulatory System

Veins of Nasal Fossae: See above
Dorsal Aorta: *Dendritobilharzia pulverulenta*
Veins – Hepatic Portal, Mesenteric, Intestinal: *Austrobilharzia*, *Bilharziella*, *Gigantobilharzia*, *Jilinobilharzia*, *Trichobilharzia*
Renal Veins: *Bilharziella*, *Trichobilharzia*

Excretory System

Kidney – Tissue: *Renicola*
Kidney – Tubules and Ureters: *Eucotyle*, *Tanaisia*, *Renicola*, *Prosthodendrium*

Reproductive System

Oviduct: *Prosthogonimus*

Digestive System

Liver: *Bilharziella*, *Trichobilharzia*, *Gymnophallus mollissima*, *Pegosomum ixobrychi*, *Brachylecithum*, *Lyperosomum*, *Proacetabulorchoides* ?, *Metorchis*
Bile Ducts: *Amphimerus*, *Metorchis*, *Opisthorchis*, *Pachytrema*, *Clonorchis*
Gall Bladder: *Gymnophallus bilis*, *Gymnophallus choledochus*, *Gymnophallus deliciosus*, *Athesmia*, *Wetzelitrema*, *Amphimerus*, *Clonorchis*, *Metorchis*, *Opisthorchis*, *Pachytrema*
Pancreas or Pancreatic Duct: *Lyperosomum anatis*, *Pancreatrema*, *Corrigia*, *Amphimerus elongatus*
Esophagus: *Psilorchis seekhpari*
Proventriculus: *Ribeiroia*, *Pseudopsilostoma*
Gizzard: None, except by reverse peristalsis from intestine
Duodenum: *Diplostomum*, *Apatemon*, *Cotylurus*, *Lacunovermis ceratostomus*, *Echinoparyphium*, *Petasiger*, *Psilochasmus*, *Ascocotyle*
Small Intestine: Cyathocotylidae, Diplostomatidae, Strigeidae; *Brachylaemus*, *Lacunovermis*, *Meiogymnophallus*, *Gymnophallus rostratus*, *Parvatrema*, Echinostomatidae, Psilostomatidae, *Catatropis*, *Notocotylus*, *Paramonostomum*, *Nanophyetus*, *Athesmia*, *Pleuropsolus*, Microphallidae, *Plagiorchis*, *Lecithodollfusia*, Heterophyidae, *Proacetabulorchoides* ?, *Euamphimerus* ?, *Metorchis*

Large Intestine: *Cyathocotyle, Holostephanus, Mesostephanus, Cotylurus, Leucochloridium, Meiogymnophallus jamesoni, Gymnophallus gibberosus, Gymnophallus skrjabini, Echinochasmus, Episthmium, Stephanoprora, Echinoparyphium, Echinostoma, Hypoderaeum, Metechinostoma, Cloacitrema, Notocotylus, Paramonostomum, Tristriata, Prosthogonimus, Maritrema, Microphallus*

Ceca: *Cyathocotyle, Holostephanus, Apatemon, Cotylurus, Gymnophallus gibberosus, Gymnophallus somateriae, Paragymnophallus odhneri, Echinochasmus beleocephalus, Echinochasmus mergi, Episthmium, Moliniella, Echinostoma, Psilochasmus, Sphaeridiotrema, Zygocotyle, Notocotylus, Catatropis, Paramonostomum, Tristriata, Parapronocephalum, Levinseniella, Microphallus, Maritrema, Odhneria, Cryptocotyle*

Cloaca: *Holostephanus luehei, Cotylurus platycephalus, Cotylurus raabei, Leucochloridium, Parorchis, Hypoderaeum, Cloacitrema, Notocotylus gippyensis, Paramonostomum, Prosthogonimus*

Bursa of Fabricius: *Cotylurus platycephalus, Leucochloridiomorpha, Gymnophallus bursicola, Parorchis, Guaicaipuria, Episthmium colymbi, Notocotylus breviserialis, Notocotylus gippyensis, Notocotylus skrjabini, Catatropis, Prosthogonimus, Schistogonimus*

KEY TO FAMILIES AND GENERA
(Trematodes Reported in Waterfowl)

1. Adults in conjunctival sac ..... (F. PHILOPHTHALMIDAE, part) – *Philophthalmus*, see species key[1]
   Adults in cysts under skin ..... (F. COLLYRICLIDAE) – *Collyriclum*
   Adults in blood vessels ..... (F. SCHISTOSOMATIDAE) – 2
   Adults in trachea, air sacs, or nasal cavity 8
   Adults in kidneys or ureters 15
   Adults in digestive tract, including cloaca, bursa of Fabricius, liver, and pancreas 19
   Larval stages encysted in muscles; *Tetracotyle ardeae* natural infection, others experimental ..... No further identification

2. Body flattened; no gynecophoric canal (groove for holding female) in male (Figs. 1.1, 1.2) 3
   Body round or threadlike; gynecophoric canal present 4

3. No suckers; cecal reunion (union of paired ceca forming common cecum) near anterior; common cecum with lateral diverticula; in dorsal aorta (Fig. 1.1) ..... *Dendritobilharzia*, see species key
   Oral sucker and acetabulum both present; ceca unite near middle of body; no diverticula on common cecum; in veins (Fig. 1.2) ..... *Bilharziella*, see species key

4. Gynecophoric canal extends to posterior end; two suckers present; testes start anterior to cecal reunion; posterior end rounded 5
   Gynecophoric canal only in anterior portion; none, one, or two suckers present; testes start posterior to cecal reunion; posterior end generally expanded laterally, spatulate; seminal receptacle well developed 6

5. Uterus very short, ootype just posterior to acetabulum; ovary in tight spiral, 300-1,000μ long; cecal reunion slightly anterior to middle (female), or near posterior end (male); testes number 11-60 (Fig. 1.3) ..... *Austrobilharzia*, see species key
   Uterus longer, ootype more posterior to acetabulum; ovary in loose spiral, 300-1,300μ long; cecal reunion at 1/3 length of body (female), or toward posterior end (male); testes number 28-125, in middle of body; none in waterfowl ..... *Ornithobilharzia*

6. Both suckers well developed; female genital pore just posterior to acetabulum; eggs generally fusiform; one egg in uterus 7
   No acetabulum, oral sucker present or absent; female genital pore at anterior end; eggs generally ovoid; one to many eggs in uterus (Fig. 1.5) ..... *Gigantobilharzia*, see species key

7. Gynecophoric canal starts just posterior to acetabulum; seminal vesicle within borders of gynecophoric canal; genital pore at middle of canal ..... *Jilinobilharzia*, see species key
   Seminal vesicle between acetabulum and gynecophoric canal; genital pore at anterior end of gynecophoric canal; canal some distance posterior to acetabulum (Fig. 1.4) ..... *Trichobilharzia*, see species key

8. Ventral sucker present; ceca end blindly ..... (F. ORCHIPEDIDAE) – *Orchipedum*
   Ventral sucker generally absent; ceca united posteriorly in continuous loop or arc (Fig. 1.6) ..... (F. CYCLOCOELIDAE) – 9

9. Ceca simple (Fig. 1.6) 10
   Ceca with diverticula on inner side (Fig. 1.7) ..... *Typhlocoelum*, see species key

10. Testes and ovary in triangular pattern (Fig. 1.7) 11
    Testes and ovary arranged almost in line (Fig. 1.8) 13

[1]Guide to Identification of Species, pp. 36-39.

11. Vitellaria in two separate lateral fields (Fig. 1.6) ..... *Cyclocoelum* (part), see species key
Lateral fields of vitellaria unite posteriad in continuous arc (Fig. 1.9) 12

12. Uterine loops horizontally transverse, between ceca (Fig. 1.8) ..... *Neivaia*
Posterior uterine loops bent posteriad from middle, chevron-shaped; ends of uterine loops extend across ceca (Fig. 1.6) ..... *Cyclocoelum* (part), see species key

13. Ovary post-testicular; genital pore pre- or post-pharyngeal; testes in rear half of body (Fig. 1.8) ..... *Ophthalmophagus*, see species key
Ovary between testes (Fig. 1.9) 14

14. Vitellaria united in rear in continuous arc ..... *Hyptiasmus*, see species key
Vitellaria in two separate lateral fields ..... *Prohyptiasmus*

15. Body elongate, flattened; in urinary vessels (Fig. 1.10) ..... (F. EUCOTYLIDAE) – 16
Body short, pyriform with anterior end broad; in kidney tissue or vessels (Fig. 1.11) 18

16. Anterior end marked off from rest of body by transverse thickening or ridge; testes partially extracecal; ceca end blindly (Fig. 1.10) ..... *Eucotyle*, see species key
Anterior end without transverse (cervical) ridge; ceca unite posteriad in continuous arc 17

17. Esophagus present; testes lobed, diagonally arranged (Fig. 1.12) ..... *Tanaisia fedtschenkoi*, see species key
Esophagus absent; testes not lobed, arranged side by side (Fig. 1.13) ..... *Tanaisia (Tamerlania)*

18. Worms in cysts or cyst-like cavities in renal tissue, two per cyst, or free in ureters or collecting chamber of kidney; vitellaria extend posteriad to acetabulum (Fig. 1.11) ..... (F. RENICOLIDAE) – *Renicola*, see species key
Worms not in cysts; vitellaria anterior to ceca (Fig. 1.14) ..... (F. LECITHODENDRIIDAE, part) – *Prosthodendrium*

19. Ventral sucker at posterior end of body; in ceca of host (Fig. 1.15) ..... (F. PARAMPHISTOMATIDAE) – *Zygocotyle*
Ventral sucker present, not at posterior end 25
Ventral sucker lacking ..... (F. NOTOCOTYLIDAE) – 20

20. Shoulder collar present; testes and vitellaria medial to ceca (Fig. 1.16) ..... *Parapronocephalum*
Shoulder collar absent; testes and vitellaria lateral to ceca (Fig. 1.17) 21

21. Ventral surface without ventral papillae (glands) ..... *Paramonostomum*, see species key
Ventral surface with ventral papillae (commonly called glands) in longitudinal rows (Figs. 1.18-1.21) 22

22. Single medial row of isolated papillae (Fig. 1.19) ..... *Notocotylus* (part), see species key
Ventral papillae in three rows (Figs. 1.18, 1.20, 1.21) 23

23. Papillae in three rows of rod-shaped ridges (Fig. 1.20) ..... *Tristriata*, see species key
Outer rows, at least, formed of round isolated papillae 24

24. Medan row of papillae in form of continuous ridge (Fig. 1.21) ..... *Catatropis*, see species key
All three rows formed by isolated papillae ..... *Notocotylus* (part), see species key

25. Head with spines in circumoral crown or cephalic collar (Figs. 1.22-1.24) 26
Head without crown or collar of spines 51

26. Spines in one or two rows on cephalic collar; ceca extend nearly to posterior end (Figs. 1.22, 1.26) 28
Spines in circumoral crown, no cephalic collar present (Figs. 1.23, 1.24); ceca extend only to level of ovary ..... (F. HETEROPHYIDAE, part) – 27

27. Circumoral spines in one row, may have a few accessory spines (Fig. 1.23); vitellaria posterior; oral sucker large, with funnel-shaped appendage; genital sac with armed genital sucker (gonotyl) ..... *Ascocotyle*, see species key
Double row of circumoral spines (Fig. 1.24); vitellaria extending anteriad to region of pharynx; no appendage on oral sucker; no armed gonotyl ..... *Centrocestus*

28. Testes opposite; cirrus sac absent; uterus extends laterally across ceca (Fig. 1.25) ..... (F. PHILOPHTHALMIDAE, part) – *Parorchis*
Testes tandem; cirrus sac well developed; uterus confined between ceca (Fig. 1.26) ..... (F. ECHINOSTOMATIDAE) – 29

29. Acetabulum located equatorial to postequatorial or nearly so (rear edge of acetabulum at 45/100 of body length or more posteriad) 30
Acetabulum more anteriad (rear edge less than 45/100 of body length from anterior end) 35

30. Collar spines in single row interrupted dorsally (gap at median anterior) on collar (Fig. 1.27) 31
Collar spines continuous dorsally, in single or double row (Figs. 1.28, 1.29) 32

31. Vitellaria reaching anteriad as far as acetabular region; acetabulum sometimes postequatorial .. *Echinochasmus* (part), see species key
Vitellaria with lateral fields uniting in front of acetabulum (Fig. 1.30) ..... *Episthmium*

32. Cephalic collar reduced, collar spines very small, 51 in two rows (Fig. 1.31) ..... *Protechinostoma*
Cephalic collar clearly developed, collar spines much larger than body spines 33

33. Collar spines in two (alternating) rows; vitellaria in 6–10 compact masses of large follicles, lateral (Fig. 1.32) ... *Neoacanthoparyphium*
Collar spines in one row; vitellaria in two lateral bands of follicles 34

34. Collar spines number 29; vitellaria start posterior to acetabulum; cirrus sac very long, sinuous, extends well posterior to acetabulum (Fig. 1.33) ..... *Curtuteria* (part), see species key
Collar spines 19–27; vitellaria start from acetabular region; cirrus sac smaller, slightly overlaps anterior of acetabulum (Fig. 1.34) ..... *Petasiger*, see species key

35. Vitellaria restricted to anterior part of body, anterior to testes (Fig. 1.35) ..... *Pegosomum*
Vitellaria extending into posterior part of body 36

36. Collar spines present only on ventral lobes of collar, 7–8 spines on each; body ribbon-like, 30–48 mm long; vitellaria in rear half of body, anterior to testes ..... *Aporchis*
Collar spines present all around collar; body shorter, vitellaria reach posterior end 37

37. Collar spines in one row, interrupted dorsally (Fig. 1.27) 38
Collar spines in continuous row, usually double (Figs. 1.28, 1.29) 40

38. Deep dorsal (anterior) notch in cephalic collar (Fig. 1.36); anterior limit of vitellaria in acetabular region ..... *Patagifer*
Cephalic collar without dorsal notch 39

39. Anterior limit of vitellaria in acetabular region ..... *Echinochasmus* (part), see species key
Anterior limit of vitellaria in testicular region (Fig. 1.37) ..... *Stephanoprora*, see species key

40. Uterus rather long, eggs numerous (over 75) 41
Uterus shorter, eggs not numerous (up to 55?, usually much fewer) 43

41. Testes near posterior end; body very slender; cirrus sac very long (Fig. 1.38) ..... *Himasthla*, see species key
Testes at about middle of body 42

42. Cephalic collar well developed, spines large (number 27–47); acetabulum distinctly separated from anterior end (usually by more than its own diameter) (Fig. 1.39) ..... *Echinostoma*, see species key
Collar poorly developed, cephalic spines small (number 43–55), inconspicuous; acetabulum close to anterior end (generally less than its own diameter posteriad) (Fig. 1.40) ..... *Hypoderaeum*, see species key

43. Collar spines 23; acetabulum generally nearer midbody than anterior end; cirrus sac very long, extending far past acetabulum ..... *Acanthoparyphium*, see species key
Collar spines more than 23 (or unknown—*Vermatrema*); acetabulum nearer anterior end than midbody, or about equally between 44

44. Testes conspicuously lobed (Fig. 1.41) ..... *Paryphostomum*, see species key
Testes not lobed, may be notched or indented 45

45. Body enlarged and broadly rounded posteriorly (Figs. 1.33, 1.34) 46
Body attenuated posteriorly, or at least not enlarged; vitelline follicles small 47

46. Vitelline follicles large, like bunches of grapes; collar spines 43 in two rows; testes more than own length from posterior end; cirrus sac projecting slightly below acetabulum (Fig. 1.42) ..... *Parechinostomum*
Vitelline follicles small; collar spines 29, in one row; testes less than own length from rear end; cirrus sac very long (Fig. 1.33) ..... *Curtuteria*, see species key

47. Cephalic collar short (low), oral sucker projecting posteriad in ventral notch of collar (Fig. 1.43); acetabulum about its own diameter posteriad to cephalic collar 48
Cephalic collar longer, oral sucker not projecting at posterior; acetabulum more posterior 49

48. Genital pore with muscular sucker or sphincter; cephalic collar spines in single row, number unknown; body elongate, 10.5–11.7 mm long, maximum width at testes ..... *Vermatrema*
Genital pore normal, without pronounced muscular development; collar spines in double row, number 30 (Fig. 1.43); body very slender, 11–13 mm long, maximum width at acetabulum ..... *Metechinostoma*

49. Collar spines differing in size alternately in two rows on dorsal side (Fig. 1.28) ..... *Echinoparyphium*, see species key
Collar spines all same size dorsally, in two rows 50

50. Body very slender, swollen at acetabulum, 3.1–4.5 mm long; cephalic collar with 35 spines; eggs very few; vitellaria start midway between ovary and acetabulum ..... *Moliniella*
Body fusiform, maximum width at testes, 3.9–5.0 mm long; cephalic collar with 29–45 spines; 10–20 eggs in uterus; vitellaria start midway between ovary and acetabulum or more anteriad, confluent posteriad or not ..... *Euparyphium*, see species key

51. Additional holdfast organ posterior to acetabulum; body divided into two regions, more or less distinct—shows: (*a*) distinct forebody and hindbody, (*b*) thin spatulate forebody merging into thick hindbody, or (*c*) divisions indistinct but holdfast very large and prominent; genital pore at posterior of body (Fig. 1.44) 52
Additional holdfast organ not present; body not divided into two regions (but see couplet 75, Fig. 1.65—*Galactosomum*) 66

52. Body generally elongate, two regions rather distinct (Fig. 1.44*a*, *b*); cirrus sac replaced by genital bulb, or cone, a muscular structure traversed by hermaphroditic canal 56
Body generally oval, compact; body regions poorly evident; holdfast organ large, sucker-like (Fig. 1.44*c*); cirrus sac well developed ..... (F. CYATHOCOTYLIDAE)—53

53. Body thick, compact; testes placed obliquely or side by side; holdfast rather anterior or central in position; acetabulum anterior 54
Body pyriform or ovoid; testes tandem; holdfast more posterior; acetabulum near middle of body or absent (Fig. 1.45) 55

54. Body with ventral cavity into which holdfast organ protrudes, about 2/3 width of body (Fig. 1.46) ..... *Holostephanus*, see species key
Body without ventral cavity; holdfast organ very large, projecting on ventral surface, 1/2–2/3 extent of body (Fig. 1.47) ..... *Cyathocotyle*, see species key

55. Body ovoid or pyriform; vitellaria enclose area of gonads; no vaginal sphincter (Fig. 1.45) ..... *Paracoenogonimus*, see species key
Forebody linguiform (Fig. 1.44*b*), edges incurved at posterior, hindbody conical; vitellaria surround holdfast organ; holdfast organ with median cavity; vaginal sphincter present ..... *Mesostephanus*

56. Forebody leaf-shaped, flattened; holdfast organ compact (Fig. 1.44*b*) ..... (F. DIPLOSTOMATIDAE) – 57
Forebody cup- or bulb-shaped; holdfast organ two- or three-lobed, foliaceous, within bulb of forebody (Fig. 1.44*a*) ..... (F. STRIGEIDAE) – 62

57. Pseudosuckers absent (Figs. 1.48, 1.51, 1.52) 58
Pseudosuckers present, flanking oral sucker (Figs. 1.49, 1.53) 61

58. Body distinctly divided 59
Body division indistinct; forebody thin, concave; hindbody thick, rounded; bursa evaginable (Fig. 1.48) ..... *Ornithodiplostomum*, see species key

59. Forebody oval, short; hindbody cylindrical, at right angle, several times longer; vitellaria only in hindbody; testes round (Fig. 1.50) ..... *Uvulifer*
Forebody flattened; vitellaria extend into forebody; testes irregular or horseshoe-shaped 60

60. Forebody narrow, margins infolded; genital atrium subterminal, small, containing genital papilla (Fig. 1.51) ..... *Neodiplostomum*
Forebody wide, concave, margins not infolded; genital atrium opens terminally, can be everted as free papilla within lateral folds (Fig. 1.52) ..... *Posthodiplostomum*

61. Genital cone present; division of body slight; hindbody always conical (Fig. 1.53) ..... *Tylodelphys*, see species key
Genital cone absent; body division usually easily seen (Fig. 1.49) ..... *Diplostomum*, see species key

62. Vitellaria distributed in both body regions 63
Vitellaria confined to hindbody 64

63. Forebody with paired lateral expansions (Fig. 1.54) ..... *Parastrigea*
Forebody almost spherical; no lateral expansions; eggs number up to 25 (Fig. 1.55) ..... *Cotylurus* (part), see species key

64. Genital bulb present, muscular, protrusile; testes trilobed, lobes directed posteriad (Fig. 1.55) ..... *Cotylurus* (part), see species key
Genital cone present, not protrusile; testes bilobed or multilobed 65

65. Uterus opens through small genital cone into copulatory bursa; ovary at middle of hindbody (Fig. 1.56) ..... *Pseudapatemon*
Genital cone 1/3 to 1/7 of hindbody length, traversed by hermaphroditic canal; ovary in anterior quarter of hindbody (Fig. 1.57) ..... *Apatemon*, see species key

66. Genital atrium and pore in close structural relation to acetabulum; cirrus sac present or absent 67
Genital pore and atrium not in close structural relation to acetabulum 91

67. Acetabulum enclosed with genital atrium and genital pore in ventro-genital sac; genital sucker or spiny gonotyl present; cirrus sac absent; ceca usually long ..... (F. HETEROPHYIDAE) – 68
Genital sucker and gonotyl absent, genital atrium present; ceca very short 76

68. Vitellaria rather extensively developed, reaching forward to acetabulum or further 69
Vitellaria limited in extent, in posterior third 70

69. Testes oblique; vitellaria in two lateral fields or scattered; esophagus extends 1/3 length of body (Fig. 1.58) ..... *Apophallus*, see species key
Testes opposite; vitellaria uniting anterior to acetabulum; esophagus extends 1/4 of body length or less (Fig. 1.59) ..... *Cryptocotyle*, see species key

70. Uterus reaching posterior end 71
Uterus usually not reaching posterior end 72

71. Testis single, near posterior end 74
Testes two, usually asymmetrical, at middle to 2/3 length of body 75

72. Testes tandem or diagonal (oblique); vitellaria extend anteriad of ovary (Fig. 1.60) ..... *Heterophyopsis*
Testes opposite; vitellaria lateral to ovary and testes 73

73. Genital sinus around acetabulum; genital sucker lens-shaped, at left of sinus; two seminal vesicles (Fig. 1.61) ..... *Pygidiopsis*
Strong genital sucker anteriad and left of acetabulum; seminal vesicle (?) before genital sucker (Fig. 1.62) ..... *Sonkulitrema*

74. Seminal vesicle forming muscular expulsor, prominent sausage-shaped or fusiform; acetabulum by gonotyl armed with minute spines in ventrogenital sac (Fig. 1.63) ..... *Procerovum*, see species key
Seminal vesicle without muscular expulsor; acetabulum not sucker-like, bearing cuticular bars or spines; no gonotyl (Fig. 1.64) ..... *Haplorchis*, see species key

75. Body divided by constriction into two parts; testes lobate (Fig. 1.65) ..... *Galactosomum*
Body without constriction; testes oval, smooth (Fig. 1.66) ..... *Stictodora*, see species key

76. Genital pore and atrium anterior to acetabulum ..... (F. FELLODISTOMATIDAE) – 77
Genital pore and atrium lateral to acetabulum ..... (F. MICROPHALLIDAE) – 81

77. Ventral pit anterior to acetabulum, muscles around pit and genital pore; genital pore large, some distance anterior to acetabulum; oral sucker with two papillae or lobes (Fig. 1.67) ..... *Lacunovermis*, see species key
No ventral pit present 78

78. Vitellaria in paired or unpaired compact mass of follicles; genital atrium shallow and genital pore wide, some distance anterior to acetabulum; seminal vesicle club-shaped (Fig. 1.68) ..... *Parvatrema*, see species key
Vitellaria in paired masses or clusters of follicles 79

79. Oral sucker slightly (up to 1.5 times) larger than acetabulum; seminal vesicle bipartite; mostly in gall bladder or bursa of Fabricius of host, but also in intestine or ceca (Fig. 1.69) ..... *Gymnophallus*, see species key
Oral sucker about twice as large as acetabulum 80

80. Genital pore very small, on anterior lip of acetabulum; seminal vesicle club-shaped (Fig. 1.70); in intestine or ceca of host ..... *Meiogymnophallus*, see species key
Genital pore a wide slit anterior to acetabulum; seminal vesicle bipartite (Fig. 1.71); in intestine of host ..... *Paragymnophallus*

81. Cirrus pouch present 82
Cirrus pouch absent 88

82. Acetabulum absent; genital pore lateral, at level of cecal fork (Fig. 1.72) ..... *Anacetabulitrema*
Acetabulum present; genital pore by acetabulum in middle portion of body 83

83. Esophagus very short, ceca in anterior 1/5 of body, anterior to acetabulum 84
Esophagus elongate, ceca at 1/3 to 1/2 of body length, at about level of acetabulum 85

84. Genital atrium a spiny plate on side of acetabulum; testes round, just posterior to acetabulum; vitellaria in posterior ring; uterus with anterolateral loop extending on each side to esophageal level (Fig. 1.73) .....
Quasimaritrema
Genital papilla with muscular pocket; testes bean-shaped, at posterior end of body; vitellaria in two groups between ceca and acetabulum (Fig. 1.74) ..... *Pseudolevinseniella*

85. Genital atrium with two chitinous openings; cirrus pouch in ring encircling acetabulum (Fig. 1.76) .....
Basantisia
Male and female pores united 86

86. Genital atrium complex; vitellaria partly or entirely encircling genital gland area in chainlike formation (except *M. japonicum*); ovary medioposterior or lateral to acetabulum (Fig. 1.77) ..... *Maritrema*, see species key
Genital atrium simple; vitellaria not in circle 87

87. Vitellaria anterior and lateral to each testis, more or less in line; long axes of testes longitudinal to body; ovary lateral to acetabulum (Fig. 1.78) ..... *Odhneria*, see species key
Vitellaria in two rosettes, lateral to testes; long axes of testes horizontal; ovary lateral or anterolateral to acetabulum (Fig. 1.79) ..... *Pseudospelotrema*

88. Genital atrium with supplementary male copulatory pouch or pocket (Fig. 1.80) 89
Genital atrium without supplementary pouch 90

89. Male copulatory pouch round, with 3–12 cuticular pockets with ribs or hooks; male papilla fleshy and massive, or absent (Fig. 1.80) ..... *Levinseniella*, see species key
Male copulatory pouch highly folded, muscular, without pockets; female pouch thick-walled; male papilla small, conical (Fig. 1.81) ..... *Ascorhytis*
Male copulatory pouch muscular, enclosing long spicule or spicular plate; male papilla large (Fig. 1.82) .....
Spiculotrema

90. Male papilla small, muscular, fills genital atrium (Fig. 1.83) ..... *Microphallus*, see species key
Male papilla small, born on wall of genital atrium; atrium with folded fibrous wall with no supports, can be everted (Fig. 1.84) ..... *Atriophallophorus*

91. Cirrus pouch absent; genital pore anterior and to right of acetabulum; each ceca with anus; vitellaria median, in two groups of four follicles each (Fig. 1.85) ..... (F. HETEROPHYIDAE, part) – *Jubilarium*
Cirrus pouch absent; genital pore preacetabular; no anus; vitellaria lateral .... (F. OPISTHORCHIIDAE) – 92
Cirrus pouch present 97

92. Oral sucker very small or absent 93
Oral sucker more or less well developed 94

93. Oral sucker absent; esophagus short; body very slender, elongate (Fig. 1.86) ..... *Amphimerus* (part), see species key
Oral sucker very small, 28μ long by 36μ; esophagus very long (1,430μ); vitellaria extend posteriad past testes (Fig. 1.87) ..... *Euamphimerus*

94. Vitellaria extend posteriad past testes; uterine coils not surrounding acetabulum 95
Vitellaria largely anterior to ovary; uterine coils more or less surrounding acetabulum (Fig. 1.88) .....
Metorchis, see species key

95. Body ovate, thickened; vitellaria in two lateral rows of clusters of follicles; ovary posterior to testes (Fig. 1.89) ..... *Pachytrema*
Body long, nearly cylindrical; vitellaria usually interrupted at level of ovary; esophagus short .....
Amphimerus (part), see species key

Body elongate, not cylindrical; vitellaria without gap at level of ovary; esophagus short 96

96. Testes deeply branched (Fig. 1.90) ..... *Clonorchis*
Testes irregular or lobed (Fig. 1.91) ..... *Opisthorchis*, see species key

97. Genital pore in posterior half of body 98
Genital pore at level of acetabulum or more anterior 100

98. Genital pore at posterior tip; vitellaria lateral, extending from pharynx to posterior end (Fig. 1.92) .....
(F. LEUCOCHLORIDIIDAE) – *Leucochloridium*, see species key
Genital pore posteriad, but not at tip ..... (F. BRACHYLAEMIDAE) – 99

99. Vitellaria along anterior half of acetabulum; genital pore at testes or posterior to them (Fig. 1.93) .....
Leucochloridiomorpha, see species key
Vitellaria lateral, from acetabulum to testes; genital pore pretesticular or ventral to anterior testes (Fig. 1.94) ..... *Brachylaemus*
Vitellaria lateral, from testes midway toward acetabulum; genital pore posterior to testes (Fig. 1.95) .....
Amblosoma

100. Genital pore not at anterior tip 102
Genital pore by anterior tip ..... (F. HAPLOMETRIDAE) – 101

101. Two genital pores close together (Fig. 1.96) ..... *Prosthogonimus*, see species key
Two genital pores distinctly separate (300μ apart) (Fig. 1.97) ..... *Schistogonimus*
Genital pores open into genital atrium to left of oral sucker; body cylindric, without spines; suckers deeply cupped (Fig. 1.98) ..... *Cylindrotrema*

102. Ovary post-testicular 103
Ovary pre-testicular 109

103. Testes in posterior half of body; vitellaria in two clusters anterior to acetabulum (Fig. 1.99) .....
(F. LECITHODENDRIIDAE) – *Pleuropsolus*
Testes in anterior half of body; vitellaria lateral, posterior to acetabulum ..... (F. DICROCOELIIDAE) – 104

104. Acetabulum absent; uterus nearly filling entire body ..... *Pancreatrema*
Acetabulum present 105

105. Testes anterior to acetabulum; vitellaria extending to posterior end of body (Fig. 1.100) .....
Proacetabulorchoides
Testes posterior to acetabulum 106

106. Vitellaria unilateral, confined to posterior part of body (Fig. 1.101) ..... *Athesmia*
Vitellaria in two lateral bands 107

107. Anterior vitellaria at about level of ovary, posterior to testes 108
Anterior vitellaria at level of testes, extend considerable distance posteriad; ceca not reaching posterior end of body; esophagus over 200μ long (Fig. 1.102) ..... *Lyperosomum*

108. Vitellaria extend short distance posteriad from level of ovary (Fig. 1.103) ..... *Brachylecithum*
Vitellaria extend about 700μ posteriad from near ovary; ceca reach posterior end of body; genital pore posterior to cecal fork; esophagus absent (Fig. 1.104) ..... *Corrigia*

109. Vitellaria in thick dorsal layer of follicles; genital pore posterior to acetabulum (Fig. 1.105) .....
(F. NANOPHYETIDAE) – *Nanophyetus*

Vitellaria in clusters, anterior to acetabulum **110**
Vitellaria in lateral bands or zones, which may unite anteriad or posteriad **111**

110. Genital pore median, anterior and lateral to acetabulum (Fig. 1.106); in gall bladder of host .....
(F. DICROCOELIIDAE, part) – *Wetzelitrema*
Genital pore lateral, by acetabulum; ovary anterior to acetabulum (Fig. 1.107); in intestine of host .....
(F. STOMYLOTREMATIDAE) – *Lecithodollfusia*

111. Uterus with well defined coils posterior to ovary (Fig. 1.108) ..... (F. PLAGIORCHIIDAE) –
Plagiorchis, see species key
Uterus for most part anterior to ovary and testes **112**

112. Vitellaria not extending posteriad of anterior testis (Fig. 1.109); in cloaca of host .....
(F. PHILOPHTHALMIDAE, part) – *Cloacitrema*, see species key
Vitellaria overlapping ceca, extending to posterior end; in intestine of host **113**

113. Esophagus with pair of lateral diverticula (often obscure); vitellarian fields confluent anteriad of acetabulum and at posterior end (Fig. 1.110) ..... (F. CATHAEMASIIDAE, part) – *Ribeiroia*
Esophagus without lateral diverticula; vitellarian fields unite only at posterior end or not at all, rarely extend anteriad of acetabulum **114**

114. Body ribbon-like, 30 mm long; testes and ovary slightly posterior to middle (Fig. 1.111) .....
(F. ECHINOSTOMATIDAE, part) – *Cotylotretus*
Body shorter, not over 12 mm long ..... (F. PSILOSTOMATIDAE) – **115**

115. Body ovoid, short; acetabulum enormous, equatorial or post-equatorial; vitellaria lateral, extending from level of pharynx to testes (Fig. 1.112) ..... *Sphaeridiotrema*
Body more or less elongate; vitellaria usually posterior in lateral fields; acetabulum less prominent (but still large) **116**

116. Caudal process present; cirrus pouch very long, reaching to near ovary; testes elongate (Fig. 1.113) .....
Psilochasmus, see species key
No caudal process; cirrus sac usually not very long **117**

117. Body rather plump; acetabulum just pre-equatorial **118**
Body more or less elongate, sometimes rather slender; acetabulum near anterior end **120**

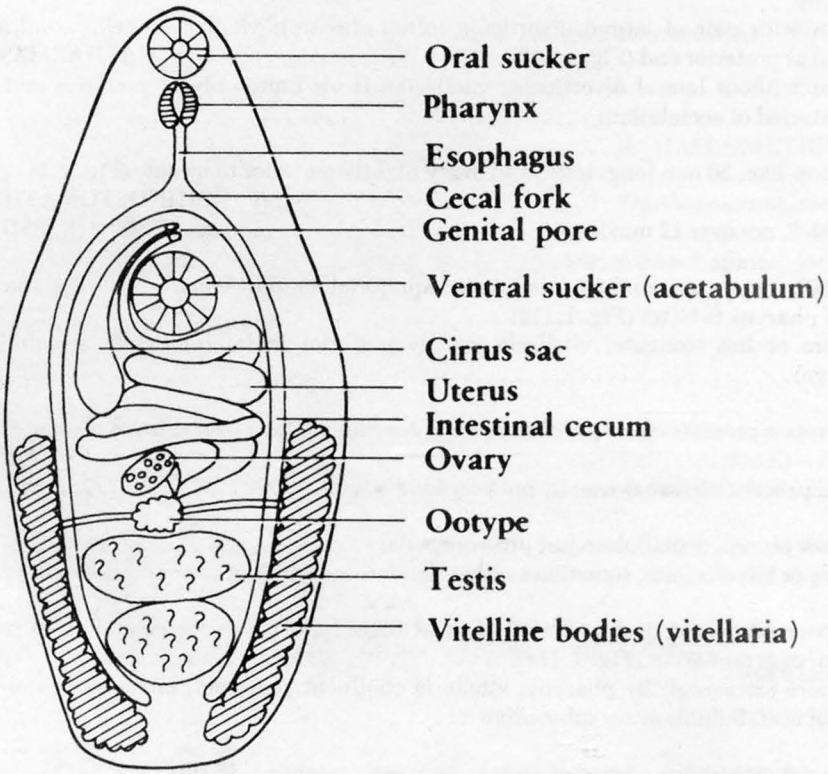
118. Genital pore intercecal, just posteriad of or at cecal fork; cirrus sac extending to rear of acetabulum; ovary median; eggs numerous (Fig. 1.114) ..... *Psilostomum*, see species key
Genital pore extracecal, by pharynx; vitellaria confluent posteriad; cirrus sac usually extending slightly posteriad of acetabulum; ovary submedian **119**

119. Vitellaria not extending anteriad of acetabulum; eggs number 1–15 (Fig. 1.115) ..... *Psilotrema*,
see species key
Vitellaria starting at level of pharynx; eggs numerous (Fig. 1.116) ..... *Pseudopsilostoma*

120. Testes anterior to midline of body (Fig. 1.117) ..... *Sharmaia*
Testes posterior to midline; vitellaria in two separate lateral bands **121**

121. Genital pore not muscular; vitellaria start at posterior border of acetabulum or more posterior (Fig. 1.118)
..... *Psilorchis*, see species key
Genital pore and atrium very muscular; vitellaria start anteriad of acetabulum (Fig. 1.119) .....
(F. CATHAEMASIIDAE, part) – *Guaicaipuria*

Trematode Anatomy



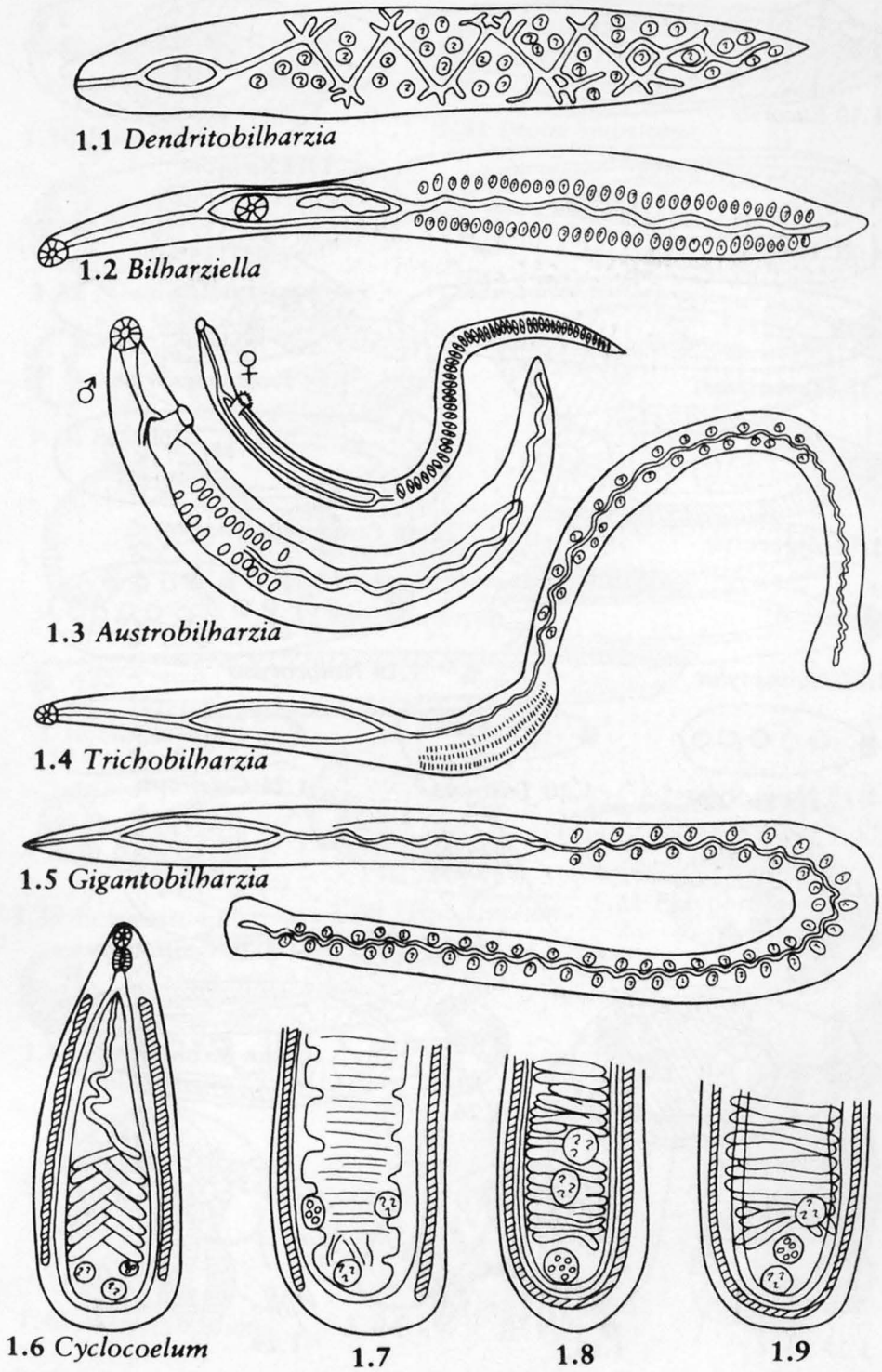


Fig. 1. Trematoda

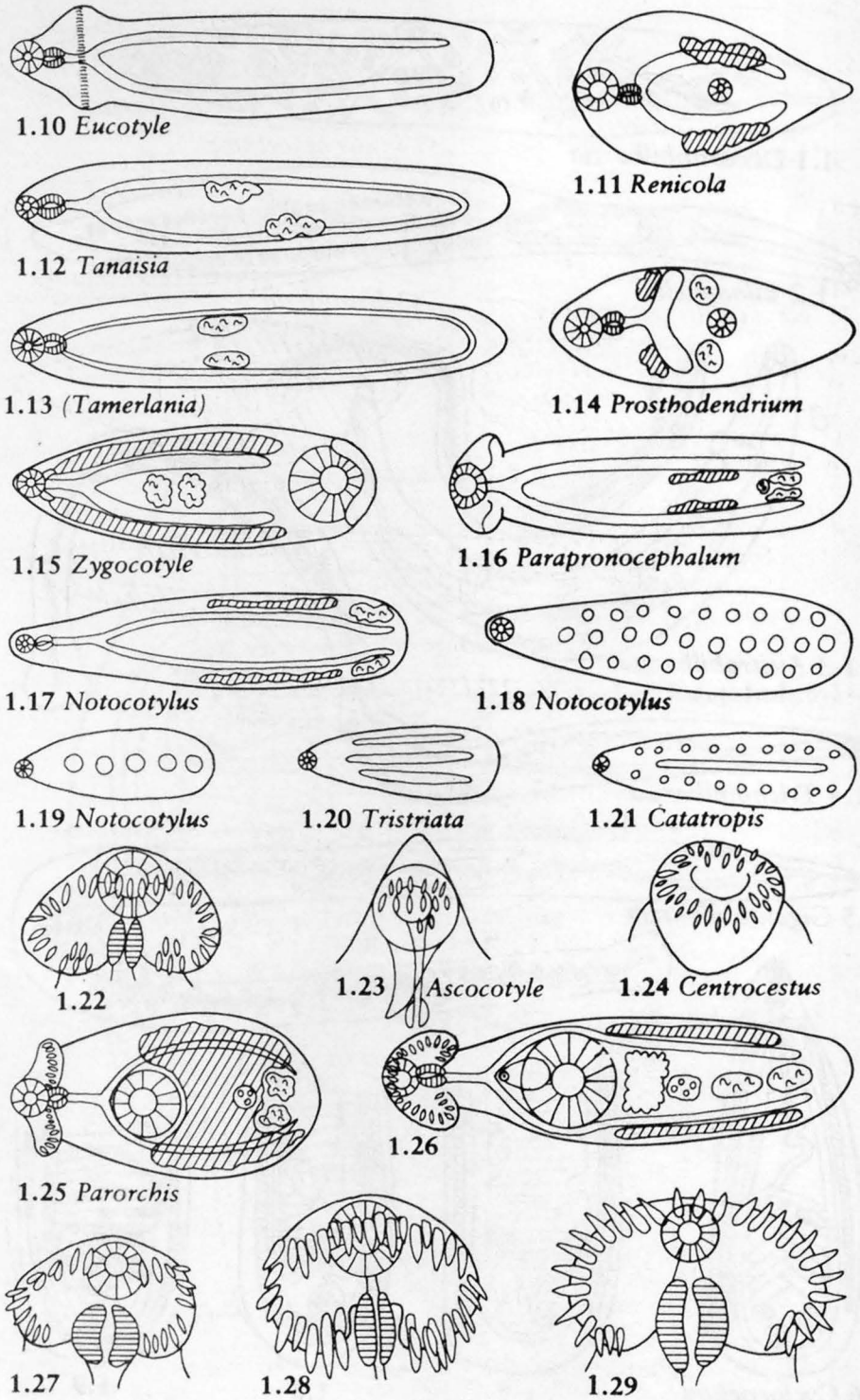


Fig. 1. Trematoda (cont. - 2)

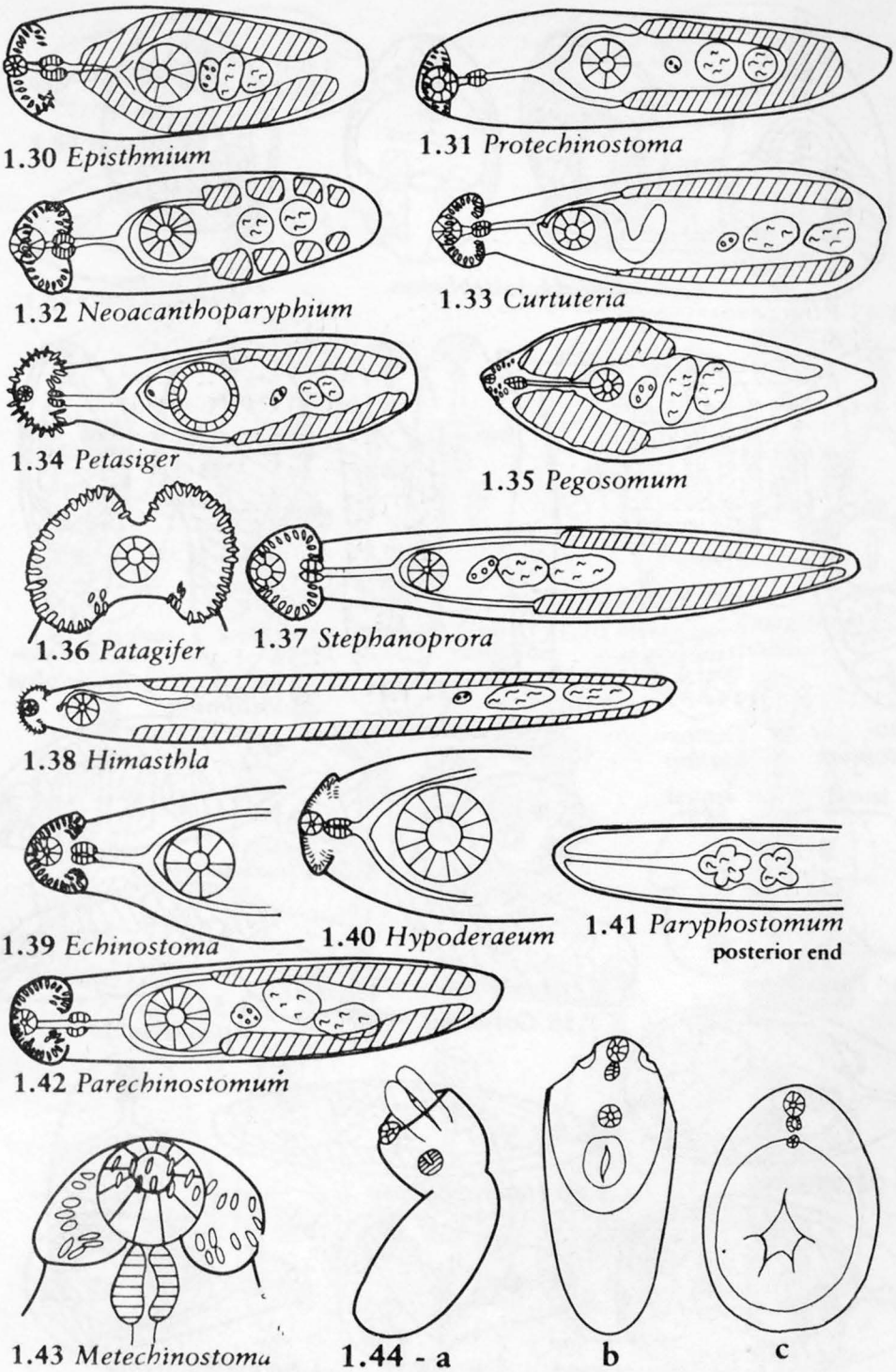


Fig. 1. Trematoda (cont. - 3)

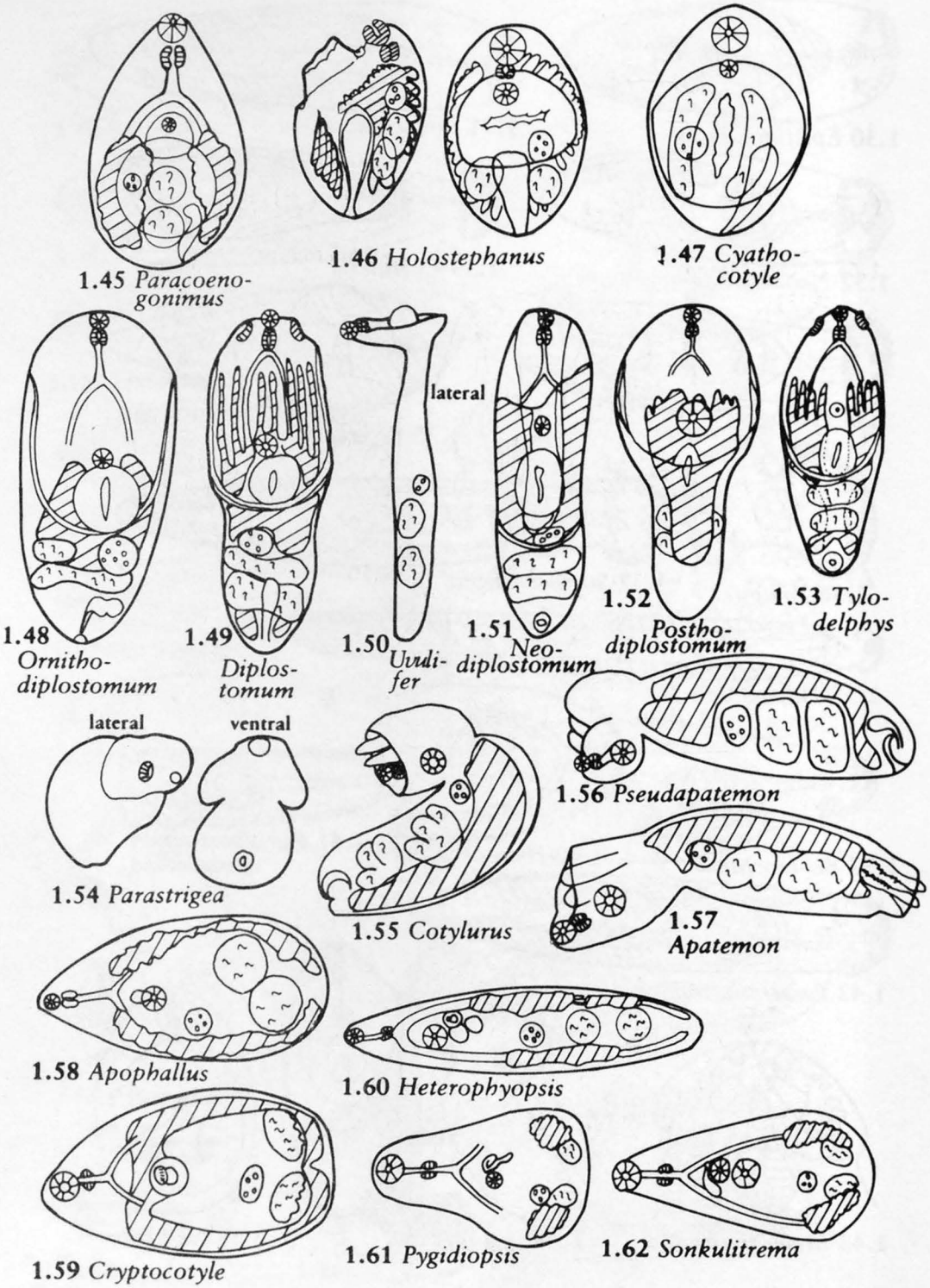


Fig. 1. Trematoda (cont. - 4)

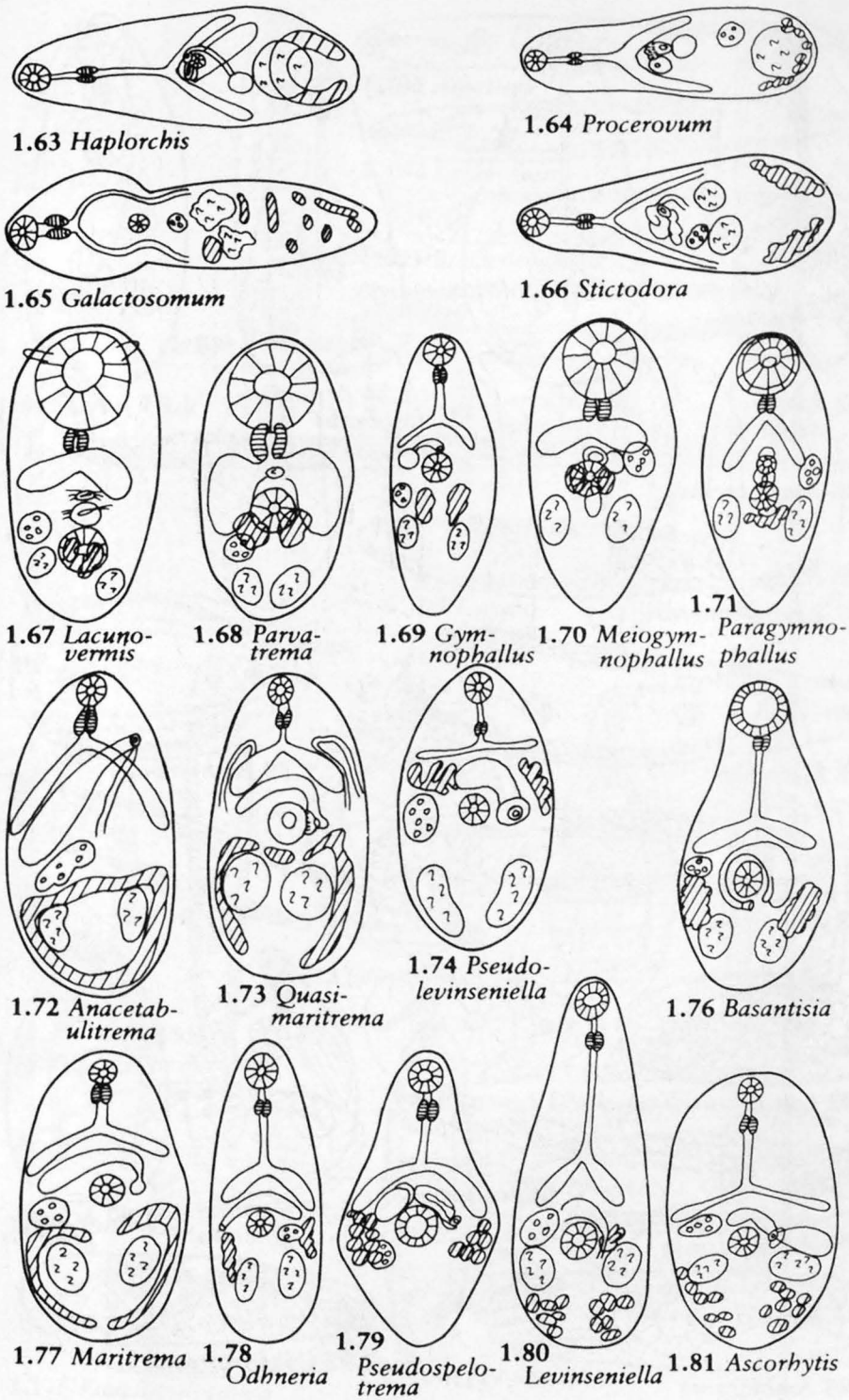


Fig. 1.75 was intentionally deleted by the author.

Fig. 1. Trematoda (cont. - 5)

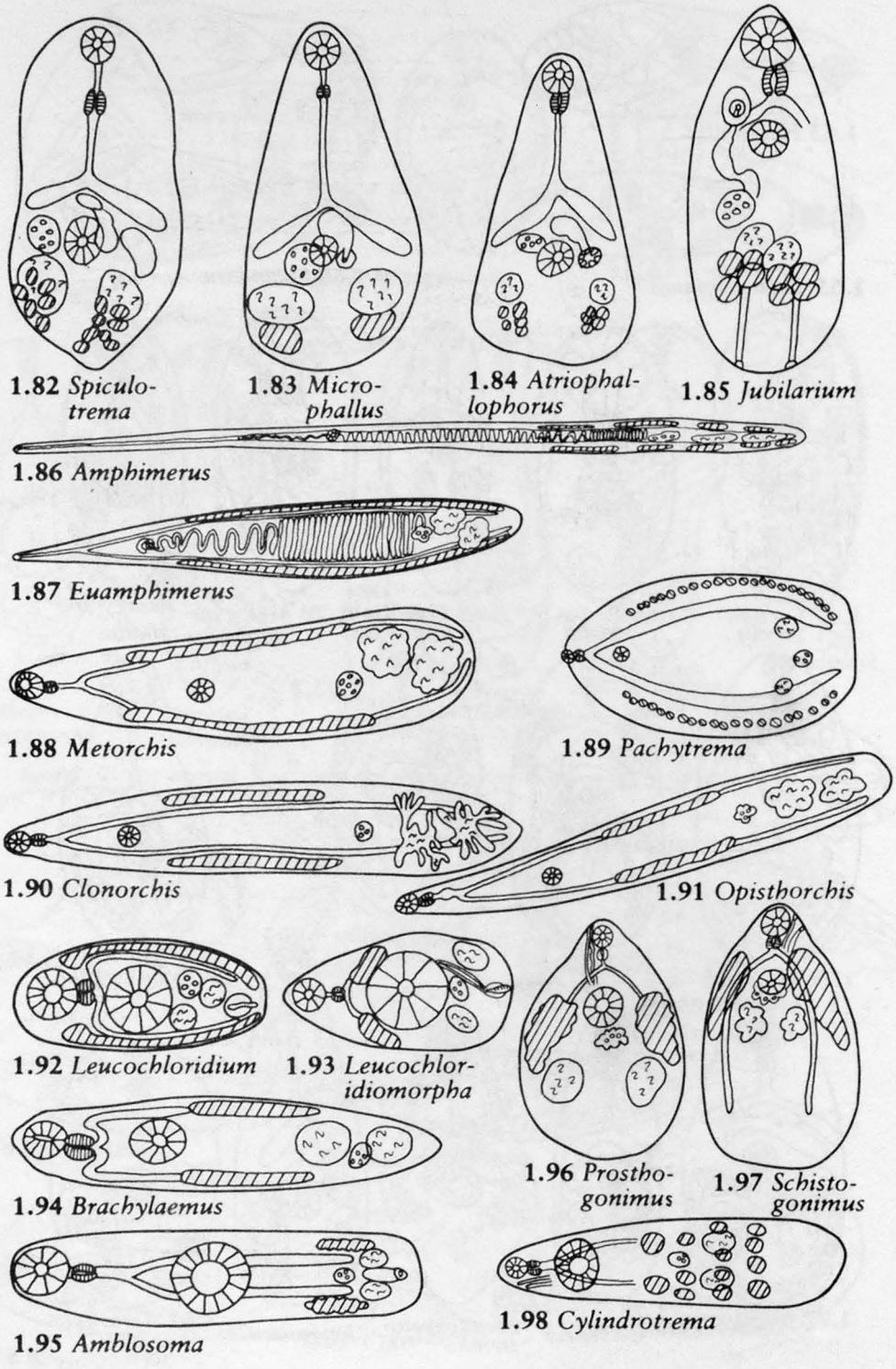


Fig. 1. Trematoda (cont. - 6)

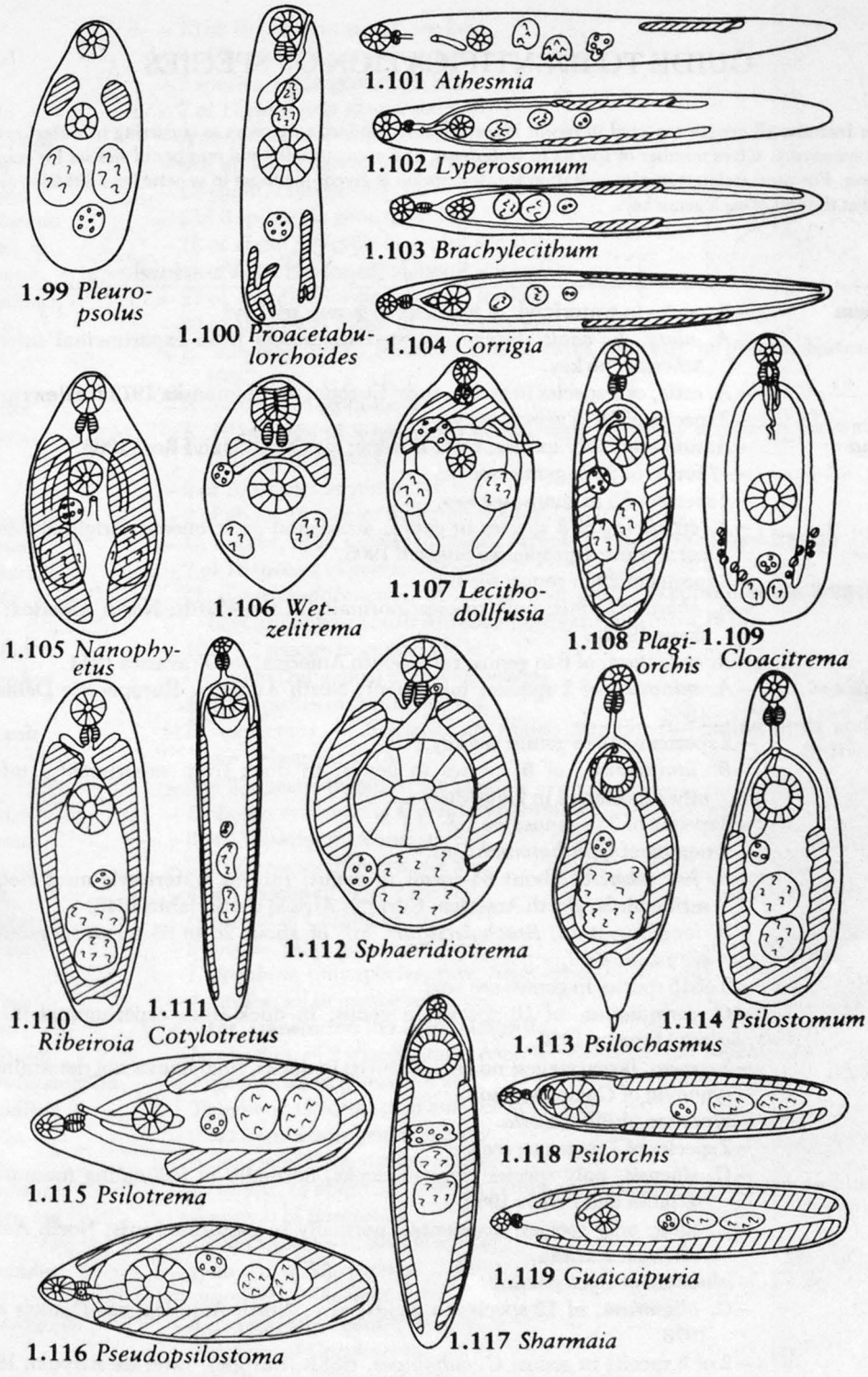


Fig. 1. Trematoda (cont. - 7)

GUIDE TO IDENTIFICATION OF SPECIES

Note: Includes all genera reported in recent literature and standard references as occurring in waterfowl, with synonymy. Gives number of species in waterfowl, and approximate total number of species for comparison. For most isolated species a citation for description is given; for those in generic keys citations are listed at the end of each genus key.

Genus	Species Reported in Waterfowl
Acanthoparyphium	– 5 species in waterfowl, of 9 species in genus; see key[2]
Alaria	– *A. alata, A. canis;* larvae encysted in muscle from experimental infections; North America; no key.
Amblosoma	– *A. exile*, of 2 species in genus; rare; Europe; see Pojmanska 1972 for description.
Amphimerus	– 3 species of 18 in genus; see key.
Anacetabulitrema	– *A. samarae*, only species; rare; Europe; see Deblock and Rosé 1965.
Apatemon	– 17 forms of 20 in genus; see key.
Apophallus	– 2 species of 9 in genus; see key.
Aporchis	– *A. croaticus*, of 8 species in genus; accidental or erroneous, originally described from cormorant; Europe; see Stossich 1905.
Ascocotyle	– 2 species of 29 in genus; see key.
Ascorhytis	– *A. charadriformis*, only species; normally in shorebirds; North America; see Belopol'skaya 1952*a*.
Athesmis	– *A. rudectum*, of 6 in genus; rare; South America; see Travassos 1944.
Atriophallophorus	– *A. minutus*, of 2 species; infrequent; North America, Europe; see Deblock and Rosé 1965.
Austrobilharzia	– 2 species of 10 in genus; see key.
Basantisia	– *B. tamsuiensis*, of 5 species in genus; in duck from experimental infection; Asia; other species all in kingfishers.
Bilharziella	– 2 species of 3 in genus; see key.
Bothrigaster	– synonym of *Ophthalmophagus*.
Brachylaemus	– *B. fuscatum*, of about 64 forms in genus; rare in waterfowl, most frequent in passerine birds; North America, Eurasia, Africa; see Skrjabin 1948.
Brachylecithum	– *B. longibursatum*, *Brachylecithum* sp., of about 26 to 65 forms in genus; rare; Asia; see Panin 1977.
Catatropis	– 9 of 15 species in genus; see key.
Centrocestus	– *C. formosanus*, of 10 species in genus; in duck from experimental infection; Asia; see Morozov 1952.
Cercaria	– 2 species, larval stages; no key. Matured in ducks, final names not determined.
Cercarioides	– synonym of *Galactosomum*.
Chinhuta	– synonym of *Bilharziella*.
Cloacitrema	– 2 species of 7 in genus; see key.
Clonorchis	– *C. sinensis*, only species; rare in ducks, normally in fish-eating mammals; Asia; see Skrjabin and Petrov 1950.
Collyriclum	– *C. faba*, only species; accidental, normally in passerine birds; North America, South America, Eurasia.
Corpopyrum	– synonym of *Cyclocoelum*.
Corrigia	– *C. obscurum*, of 12 species in genus; rare; North America; see Daniels and Freeman 1976.
Cotylotretus	– 2 of 3 species in genus; *C. cubanicus*, USSR (Europe), rare; see Artyukh 1958; *C. grandis*, North America, South America, Europe; rare; see Kurashvili 1957. No description of *C. cubanicus* available.
Cotylurostrigea	– synonym of *Cotylurus*.

[2]Key to Species in Waterfowl, pp. 40-87.

Cotylurus – 13 of 19 forms in genus; see key.
Cryptocotyle – 4 of 7 species in genus; see key.
Curtuteria – 2 species, all in genus; see key.
Cyathocotyle – 7 of 17 species in genus; see key.
Cyathocotyloides – synonym of *Holostephanus*.
Cyclocoelum – 6 of about 32 species in genus; see key.
Cylindrotrema – *C. cygni*, only species; rare; Australia; see Angel 1973.
Dendritobilharzia – 2 of 3 species in genus; see key.
Diplostomum – 12 of about 59 forms in genus; see key.
Echinochasmus – 11 of about 51 forms in genus; see key.
Echinoparyphium – 27 of about 50 forms in genus; see key.
Echinostoma – 30 of about 194 forms in genus; see key.
Episthmium – *E. colymbi*, of 20 forms in genus; rare; typically in grebes; Eurasia; see Kurashvili 1957.
Erschoviorchis – synonym of *Amphimerus*.
Euamphimerus – *E. cygnoides*, of 6 species in genus; rare, probably erroneous for waterfowl (in "poule sauvage"); Palau I.
Eucotyle – 9 of 10 species in genus; see key.
Euparyphium – 2 of about 18 species in genus; see key.
Galactosomum – *G. baylisi*, of 21 species in genus; rare; Eurasia, Africa; see Morozov 1952.
Gigantobilharzia – 7 of 16 species in genus; see key.
Guaicaipuria – *G. parapseudoconcilia*, of 2 species in genus; experimental in domestic duck, natural host unknown; South America; see Nasir and Silva 1972.
Gymnophallus – 10 of 12 species in genus; see key.
Haematotrephus – synonym (subgenus) of *Cyclocoelum*.
Haplorchis – 2 of 17 species in genus; see key.
Heterophyopsis – *H. expectans*, of 3 species in genus; rare; in fish-eating birds and mammals; Asia; see Velasquez 1973.
Himasthla – 5 of 23 species in genus; see key.
Himasthloides – *H. bonus* synonym of *Curtuteria grummti*.
Holostephanus – 6 of 18 species in genus; see key.
Hypoderaeum – 8 of 10 species in genus; see key.
Hyptiasmus – 4 of 8 species in genus; see key.
Ichthyocotylurus – synonym of *Cotylurus*.
Jilinobilharzia – 2 species, all in genus; see key.
Jubilarium – *J. skrjabini*, only species; rare; Asia; see Morozov 1959.
Lacunovermis – 4 species, all in genus; see key.
Laterotrema – error, transferred to *Lecithodollfusia*.
Lecithodollfusia – *L. anatina*, of 2 species; rare; Asia; see Khotenovskii 1967.
Leucochloridiomorpha – 4 species, all in genus; see key.
Leucochloridium – 3 of about 42 forms in genus; see key.
Levinseniella – 9 of 25 species in genus; see key.
Linstowiella – synonym of *Paracoenogonimus*.
Lyperosomum – *L. anatis*, of about 53 forms in genus; rare; Asia; see Belogurov and Leonov 1963.
Macrostomtrema – synonym of *Basantisia*.
Maritrema – 13 of 43 species in genus; see key.
Maritreminoides – synonym of *Maritrema*.
Mehlisia – synonym of *Sharmaia*.
Meiogymnophallus – 4 species, all in genus; see key.
Mesaulus – synonym of *Cotylotretus*.
Mesorchis – synonym of *Stephanoprora*.
Mesostephanus – *Mesostephanus* sp., of 17 species in genus; accidental, probably typically in fish-eating birds; Madagascar; see Richard 1965.
Metametorchis – synonym of *Metorchis*.
Metechinostoma – *M. amurensis*, single species; rare; Asia; see Petrochenko and Khrustaleva 1963.

Metorchis – 9 of 16 species in genus; see key.

Microbilharzia – synonym of *Austrobilharzia*.

Microphallus – 14 of 49 species in genus; see key.

Moliniella – *M. anceps*, only species; rare, normally in coots and gallinules; Eurasia; see Skrjabin and Bashkirova 1956.

Monilifer – synonym of *Stephanoprora*.

Nanophyetus – *N. salmincola*, only species; rare, most commonly in fish-eating mammals; North America, Asia.

Neivaia – *N. cymbium*, only species; rare; South America; see Dubois 1959.

Neoacanthoparyphium – *N. echinatoides*, of 2 species in genus; rare; Europe; see Odening 1962*b*.

Neodiplostomum – *N. spathula*, of about 91 forms in genus; rare in waterfowl, normally in Falconiformes; Eurasia. Three other species in ducks, as larval cysts in muscles from experimental infections.

Notaulus – synonym of *Opisthorchis*.

Notocotylus – 28 of 41 forms in genus; see key.

Odhneria – 2 of 3 species in genus; see key.

Ophthalmophagus – 3 of 4 species in genus; see key.

Opisthorchis – 7 of about 42 species in genus; see key.

Orchipedum – *O. tracheicola*, of 13 forms in genus; frequent; North America, Eurasia; see Skrjabin 1947.

Ornithobilharzia – no species in waterfowl.

Ornithodiplostomum – 2 species, all in genus; see key.

Pachytrema – *P. calculus*, of 9 species in genus; rare, mostly in gulls; North America, Eurasia, Australia; see Yamaguti 1939.

Pancreatrema – *Pancreatrema* sp.; only 1 species described in genus; rare; India.

Paracoenogonimus – 2 of 5 species in genus; see key.

Paragymnophallus – *P. odhneri*, only species; rare; Europe; see Ching 1973*b*.

Parametorchis – synonym of *Metorchis*.

Paramonostomum – 17 of 33 forms in genus; see key.

Parapronocephalum – *P. symmetricum*, of 2 species in genus; rare, normally in shorebirds; Europe; see Belopol'skaya 1952*b*.

Parastrigea – *P. robusta*, of 17 species in genus; infrequent; Eurasia; see Dubois 1968.

Parechinostomum – *P. cinctum*, only species; frequent; Eurasia; see Skrjabin and Bashkirova 1956.

Parorchis – *P. acanthus*, of 10 forms in genus; in ducks from experimental infection, normally in shorebirds; North America, South America, Eurasia; see Skrjabin 1947.

Parvatrema – 5 of 10 species in genus; see key.

Paryphostomum – 4 of 10 species in genus; see key.

Patagifer – *P. bilobus*, of 10 species in genus; rare; normally in Ciconiiformes; cosmopolitan; see Skrjabin and Bashkirova 1956.

Pegosomum – *P. ixobrychi*, of 7 species in genus; rare, originally described from heron; Asia; see Oshmarin 1970.

Petasiger – 7 of 24 species in genus; see key.

Phagicola – synonym of *Ascocotyle*.

Pharyngostomum – *P. cordatum*, only species; larvae encysted in ducks from experimental infection; Eurasia.

Philophthalmus – 10 of about 26 species in genus; see key.

Plagiorchis – 5 of about 95 species in genus; see key.

Pleuropsolus – *P. somaterias*, of 5 species in genus; rare; Asia; see Morozov 1960.

Posthodiplostomum – *P. minimum*, of 18 forms in genus; experimentally in domestic duck, normally in herons and gulls; North America.

Proacetabulorchoides – *P. anatis*, only species; rare; Asia; see Oshmarin 1970.

Procerovum – 4 of 5 species in genus; see key.

Prohyptiasmus – *P. robustus*, only species; frequent; Eurasia, Australia; see Bashkirova 1950.

Promptenovum – *P. vanbenedeni, nomen nudum*.

Prosthodendrium – *Prosthodendrium* sp., of about 45 forms in genus; rare, genus normally in bats; North America; see Kocan and Kocan 1972.

Prosthogonimus – 5 species, of some 5 to 25 species in genus; see key.

Protechinostoma – *P. mucronisertulatum*, only species; in duck from experimental infection, normally in rails; North America.

Pseudapatemon – *P. mamilliformis*, of 4 species in genus; rare; Asia; see Dubois 1968.

Pseudechinostomum – *P. indicum*, *nomen nudum*.

Pseudobilharziella – synonym of *Trichobilharzia*.

Pseudolevinseniella – *P. cheni*, of 2 species in genus; in duck from experimental infection, natural host unknown; Asia; see Belopol'skaya 1963.

Pseudopsilostoma – *P. varium*, only species; rare; North America; see Skrjabin 1949.

Pseudospelotrema – *Pseudospelotrema* sp., of 2 species in genus; rare; North America; see Deblock 1972.

Pseudostrigea – *P. anatis*, unidentified; genus suppressed.

Psilochasmus – 7 of 9 forms in genus; see key.

Psilorchis – 3 of 9 species in genus; see key.

Psilostomum – 4 of 9 species in genus; see key.

Psilotrema – 7 of 9 forms in genus; see key.

Pygidiopsis – *P. genata*, of 7 species in genus; infrequent, in fish-eating birds and mammals; North America, Eurasia, Africa; see Morozov 1952.

Quasimaritrema – *Q. caridinae*, only species; rare; Asia; see Deblock 1973.

Renicola – 7 of 49 species in genus; see key.

Ribeiroia – *R. ondatrae*, only species; infrequent, typically in muskrats and fish-eating birds; North America, South America, Africa; see Skrjabin 1947.

Schistogonimus – *S. rarus*, of 2 species in genus; common; Eurasia. Reported once to be a host response of *Prosthogonimus*, but now declared a valid species; see Skrjabin 1962.

Sharmaia – *S. gatesi*, only species; rare; Asia; see Sharma 1943.

Sonkulitrema – *S. kazachstanica*, of 2 species in genus; rare; Asia; see Zhatkanbaeva 1964.

Spaniometra – synonym of *Ophthalmophagus*.

Spelotrema – synonym of *Microphallus*.

Sphaeridiotrema – *S. globulus*, only species; frequent; North America, Eurasia; see Skrjabin 1947.

Spiculotrema – *S. litoralis*, only species; rare, more frequent in shorebirds; Asia; see Belopol'skaya 1949.

Stephanoprora – 6 of 25 species in genus; see key.

Stictodora – 3 of 26 species in genus; see key.

Strigea – 3 species (2 experimental); no key; present only as larval cysts in muscles. *S. falconis;* frequent; cosmopolitan.

Tamerlania – *Tamerlania* sp., of at least 18 species in group, subgenus of *Tanaisia*; rare, mostly in passerine birds; North America, South America, Eurasia.

Tanaisia – 2 forms of *T. fedtschenkoi*, of 34 forms in genus; rare, normally in shorebirds; North America, Eurasia; see key.

Tetracotyle – *T. ardeae*; larval form of *Strigea falconis* encysted in muscles; frequent; cosmopolitan.

Tracheophilus – synonym of *Typhlocoelum*.

Transcoelum – synonym of *Hyptiasmus*.

Trichobilharzia – 28 of 34 species in genus; see key.

Tristriata – 2 species, all in genus; see key.

Tylodelphys – 3 of 21 species in genus; see key.

Typhlocoelum – 4 forms, all in genus; see key.

Typhlophilus – synonym of *Typhlocoelum*.

Uniserialis – synonym of *Notocotylus*.

Uvulifer – *U. denticulatus*, of 13 species in genus; in duck from experimental infection, normally in kingfishers; Eurasia; see Dubois 1968.

Vermatrema – *V. longitestis*, only species; rare; Asia; see Srivastava 1974.

Wetzelitrema – *W. melanitae*, only species; rare; Europe; see Rayski and Fahmy 1962.

Zygocotyle – *Z. lunata*, only species; common; North America, South America, Asia, Africa; see Skrjabin 1949.

KEY TO SPECIES IN WATERFOWL

Genus *Cyathocotyle*
Family Cyathocotylidae

Note: Infections obtained by ingestion of freshwater snails (*C. bithyniae*, *C. Bushiensis*), leeches (*C. opaca*), or fish (*C. melanittae*, *C. prussica*). Synonymy: *C. fusa*, *C. gravieri*, *C. orientalis*, and *C. szidatiana* synonyms of *C. prussica; C. fraterna* erroneous report.

1. Testes (or at least one) elongate; cirrus sac 1/5–1/3 length of body 2
   Testes ovoid; cirrus sac 1/3–1/2 of body length 5

2. No acetabulum 3
   Acetabulum present 4

3. Testes dissimilar, one ovoid, one elongate and bent in curve; cirrus sac narrow, 330μ long, extends 1/3–1/4 of body length; eggs few, 4 in original figure (Fig. 2.1); Europe; in duck from experimental infection, natural host unknown ..... *C. bithyniae*
   Testes similar, both elongate; cirrus sac 450-550μ long, extends 1/4 body length; uterus with 40-50 eggs, 73–76μ long (Fig. 2.2); N. America, Europe; infrequent ..... *C. bushiensis*

4. Cirrus sac 360–700μ long, extends about 1/5 body length; uterus with over 100 eggs, 57–81μ long (Fig. 2.3); Asia; rare ..... *C. indica*
   Cirrus sac 400–590μ long, extends about 1/3 or more of body length; uterus with up to 41 eggs, 87–101μ long (Fig. 2.4); Europe; in duck from experimental infection, natural host unknown ..... *C. opaca*

5. No acetabulum; body 1.25–1.44 mm long; testes 240–280μ long; up to 16 eggs in uterus, 108–126μ long (Fig. 2.5); Japan; rare ..... *C. melanittae*
   Acetabulum present 6

6. Cirrus sac 3/5 of body length; holdfast organ about 3/4 of body width; body 0.4–1.11 mm long; eggs number 3–12, 96–105μ long; testes 110–435μ long (Fig. 2.6); Eurasia; frequent .... *C. prussica*
   Cirrus sac about 1/2 of body length; holdfast organ over 3/4 of body width; body 1.3–1.5 mm long; eggs number about 45 in uterus, 85–92μ long; testes 656–850μ long (Fig. 2.7); Europe; in domestic duck, natural host unknown ..... *C. skrjabini*

Descriptions: Mehra 1943; Khan 1962*a*; Sudarikov 1962, 1974; Petrov and Sudarikov 1963; Vojtek 1971.

Genus *Holostephanus*
Family Cyathocotylidae

Note: Infections obtained by ingestion of freshwater fish, or amphibia (*H. volgensis*). *H. dubius*, synonymized with *H. luehei* by Erasmus but maintained as distinct species by Sudarikov, in duck from experimental infection, is not included; cannot be separated in key from *H. luehei*.

1. Cirrus sac anterior of midline on left, connected by long canal to posterior genital pore; no acetabulum; testes long-oval, in third quarter of body; eggs number 36, large, 122–129μ long (Fig. 3.1); China; rare in domestic goose ..... *H. lutzi*
   Cirrus sac in posterior half of body; acetabulum present; eggs less than 117μ long (mostly less than 100μ), number less than 15 2

2. Testes subspherical, rear testis in posterior quarter of body; body 0.95–1 mm long; holdfast organ 300μ by 500μ; eggs 90–100μ long (Fig. 3.2); Europe; rare ..... *H. curonensis*
   Testes ovoid, more anteriad, in third quarter of body 3

3. Ovary at level of middle of both testes; testes large, nearly opposite, in middle third of body; stout spines on ventral side over holdfast organ (not described in *H. dubius*); body 0.5–0.7 mm long; eggs few, 70–100μ long (Fig. 3.3); Europe; in duck from experimental infection, normally in lariform birds ..... *H. luehei*
   Ovary anterior to one testis; one or both testes entirely in posterior half of body 4

4. Testes 138–388μ long; cirrus sac 152–359μ long; body 0.538–0.742 mm long; holdfast organ 172–345μ long; eggs 1–7, 69–117μ long (Fig. 3.4); Europe; in duck from experimental infection, natural host unknown ..... *H. cobitidis*
   Testes 122–201μ long; cirrus sac 293–348μ long; body 0.448–0.736 mm long; holdfast organ 213–297μ long; eggs number 1–4, 82–98μ long (Fig. 3.5); Europe; in duck from experimental infection, natural host unknown ..... *H. volgensis*

Descriptions: Sudarikov 1962, 1974; Vojtkova 1966; Opravilová 1968.

Genus *Paracoenogonimus*

Family Cyathocotylidae

Note: *P. ovatus* infections obtained by ingestion of freshwater fish; *P. viviparus* from freshwater snails. Synonymy: *P. katsuradai* synonym of *Ornithodiplostomum ptychocheilus*.

1. Acetabulum present; holdfast organ less than half width of body; body 0.738–1.197 mm long; cirrus sac 186–288μ long; testes 175–186μ diameter (Fig. 4.1); Eurasia; infrequent, normally in birds of prey ..... *P. ovatus*
   Acetabulum absent; holdfast organ more than half width of body; body 0.33–0.376 mm long; cirrus sac 85–89μ long; testes 66–71μ diameter (Fig. 4.2); Europe; experimentally in domestic duck, natural host perhaps gulls ..... *P. viviparae*

Descriptions: Sudarikov 1962; Odening 1963*b*.

Genus *Diplostomum*

Family Diplostomatidae

Note: Infections obtained by ingestion of freshwater fish, or amphibia (*D. micradenum*). Synonymy: *D. orientale* synonym of *D. mergi; D. pelmatoides* synonym of *D. phoxini; D. baeri eucaliae* synonym of *D. scudderi; D. indistinctum* a subspecies of *D. spathaceum; D. flexicaudum* synonym of *D. spathaceum indistinctum; D. gasterostei* reported synonym of *D. pungitii*, but retained in key.

1. Pseudosuckers very large, 180–280μ long, semiovate or semilunar; vitelline glands reach anteriad of rear margin of acetabulum; pharynx equals length of oral sucker; eggs in uterus number up to 30 (Fig. 5.1); N. America, Eurasia; rare, normally in loons and grebes ..... *D. gavium*
   Psuedosuckers small, 50–145μ long, reniform or semilunar; eggs few in uterus, number 1–12 2

2. Ovary at junction of segments or at start of hindbody 4
   Ovary more posterior, at 25–28/100 of hindbody length; hindbody usually longer than forebody, ratio 0.7–2.6; testes horseshoe-shaped; oral sucker longer than pharynx; acetabulum larger than oral sucker, posterior to middle of forebody; vitelline glands usually not reaching anteriad to acetabulum, ending in two lateral terminal masses posteriad (Fig. 5.2) ..... *D. spathaceum* —3

3. Body up to 4.45 mm long; Eurasia, Africa; rare, normally in gulls ..... *D. spathaceum spathaceum*
   Body up to 3.4 mm long; N. America; rare, normally in gulls ..... *D. spathaceum indistinctum*

4. Genital atrium surrounded by muscular sucker-like formation; testes in anterior half of hindbody; body 0.7–1.42 mm long; acetabulum and oral sucker equal size (Fig. 5.3); Europe; infrequent ..... *D. phoxini*
Genital atrium normal, without muscular sucker; testes generally occupying more than half of hindbody; acetabulum generally larger than oral sucker 5

5. Oral sucker small, 40–50μ diameter, obscure; acetabulum about twice diameter of oral sucker, slightly anterior to middle of forebody; body 1.2–1.5 mm long (Fig. 5.4); Eurasia; infrequent ..... *D. parviventosum*
Oral sucker larger, obvious; acetabulum only slightly larger than oral sucker, or suckers subequal 6

6. Hindbody short, wider than long; testes filling 2/3 or 3/5 of hindbody; pharynx shorter than oral sucker (Fig. 5.5); North America, Eurasia; infrequent ..... *D. pusillum*
Hindbody longer than wide; testes filling anterior 1/2 to 3/4 of hindbody 7

7. Hindbody slightly longer than forebody 8
Hindbody shorter than forebody 9

8. Forebody pouch-like, deeply concave ventrally; anterior end not trilobed; pseudosuckers shallow, laterally at level of pharynx or its posterior margin; hindbody conical; pharynx smaller than oral sucker; vitellaria end in two lateral subterminal masses in hindbody; holdfast organ often covers acetabulum (Fig. 5.6); North America; in duck from experimental infection, natural host unknown ..... *D. micradenum*
Forebody broadly oval, ventrally concave; anterior end slightly trilobed; pseudosuckers obscure, anterior to level of pharynx; hindbody conical; pharynx longer than oral sucker; vitellaria end in two lateral subterminal masses in hindbody, extend anteriad of acetabulum in forebody (Fig. 5.7); Europe; in duck from experimental infection, natural host unknown ..... *D. gasterostei*

9. Pharynx 50μ wide or more, ellipsoid; hindbody 2–3 times longer than wide; lobation at anterior end of forebody weak, pseudosuckers small, at level of pharynx; acetabulum posterior to middle of forebody; vitelline glands extend slightly anterior to acetabulum in forebody, two lateral subterminal masses at posterior in hindbody (Fig. 5.8); North America; in duck from experimental infection, natural host unknown ..... *D. scudderi*
Pharynx less than 50μ wide; hindbody length less than twice width 10

10. Pseudosuckers small, at level of pharynx, deep in parenchyma with canals to surface; pharynx smaller than oral sucker; acetabulum slightly posterior to middle of forebody; hindbody oval; vitellaria extend anteriad to middle of fore margin of acetabulum, two posterior lateral terminal masses (Fig. 5.9); USSR; in duck from experimental infection, natural host unknown ..... *D. gobiorum*
Pseudosuckers large, prominent, at level of oral sucker and pharynx; forebody trilobed at anterior end; vitellaria extend to acetabulum or more anteriad in forebody; hindbody conical or cylindrical, narrow ..... *D. mergi* – 11

11. Pharynx longer than or equal to length of oral sucker; acetabulum much larger than oral sucker, posterior to middle of forebody; vitellaria with two posterior lateral terminal masses (Fig. 5.10); Eurasia; frequent ..... *D. mergi mergi*
Pharynx shorter than length of oral sucker; acetabulum equal in diameter to oral sucker, slightly anterior to middle of forebody; vitellaria with two posterior lateral subterminal masses; uterus with 4 eggs (Fig. 5.11); North America; rare ..... *D. mergi alascense*

Descriptions: Sudarikov 1960, 1964; Williams 1966; Dubois 1968; Shigin 1969.

Genus *Ornithodiplostomum*

Family Diplostomatidae

Note: Infections obtained by ingestion of freshwater fish. Synonymy: *O. ptychocheilus palaearcticum* synonym of *O. scardinii*.

1. Body 0.67–0.76 mm long; oral sucker 44μ long by 42μ; acetabulum 33μ long, 44μ wide, smaller than oral sucker; cuticle finely spined, especially in forebody (Figs. 6.1, 6.2); Eurasia; infrequent . . . . . *O. scardinii*

   Body smaller, 0.47–0.53 mm by 0.23–0.28 mm; oral sucker 25–30μ diameter; acetabulum 30μ diameter, about same size as oral sucker; spination in cuticle not described; North America; frequent in mergansers . . . . . *O. ptychocheilus*

Descriptions: Sudarikov 1960, 1964; Sudarikov and Kurochkin 1968.

Genus *Tylodelphys*

Family Diplostomatidae

Note: Infections obtained by ingestion of freshwater fish. Synonymy: *T. conifera* synonym of *T. clavata*.

1. Forebody not trilobed at anterior end; pseudosuckers lateral to pharynx, posterior to oral sucker; oral sucker and acetabulum about equal size; body elongate, forebody spatulate, hindbody cylindrical (Fig. 7.1); India; rare . . . . . *T. lucknowensis*

   Forebody more or less distinctly trilobed; pseudosuckers not prominent, oblique, 41–99μ long; acetabulum and oral sucker subequal (Fig. 7.2); Eurasia, Africa; rare, normally in grebes . . . . . *T. clavata*

Descriptions: Dubois 1968; Pandey 1973.

Genus *Apatemon*

Family Strigeidae

Note: Infections obtained by ingestion of freshwater fish (three forms assumed, three observed), or leeches (four assumed, four observed). Synonymy: *A. globiceps* and *A. sphaerocephalus* synonyms of *A. bdellocystis; A. casarcus* synonym of *A. indicus; A. cobitidis* and *A. pellucidus* synonyms of *A. gracilis; A. gracilis exilis* and *A. skrjabini* synonyms of *A. minor*. Dubois (1968) lists several species as *species inquirendae*. Most authors report only *A. gracilis*, now believed restricted to mergansers; the many collections called *gracilis* probably mostly pertain to *A. burti* and *A. minor*.

1. Genital cone small, poorly delimited from parenchyma, traversed by narrow hermaphroditic duct, straight and scarcely muscular (Fig. 8.1); metacercariae develop in fish 2

   Genital cone moderate to large, distinct from parenchyma by its musculature, traversed by large muscular hermaphroditic canal, walls folded and often tortuous (Fig. 8.2); metacercariae develop in leeches 10

2. Vitellaria extend into forebody up to acetabulum; pharynx about 100μ long; ovary well forward at 11–19/100 of hindbody length; eggs small, 85–94μ long (Fig. 8.3); Brazil, West Indies; rare . . . . . *A. graciliformis*

   Vitellaria not reaching into forebody except rarely in ventral wall 3

3. Pharynx small, not over 100μ diameter 5

   Pharynx large, average diameter over 100μ . . . . . *A. somateriae* – 4

4. Pharynx 75–120μ diameter (average 120μ) (Fig. 8.4); Arctic Europe; rare, in eiders . . . . . *A. s. somateriae*

   Pharynx 9–140μ diameter (average 120μ) (Fig. 8.5); North America; infrequent, in eiders and scoters . . . . . *A. somateriae fischeri*

5. Testes very small, minimum diameter 1/12 of body length, in middle third of hindbody; forebody cylindrical, 3/4 of hindbody length (Fig. 8.6); Japan; rare (*species inquirenda*) ..... *A. parvitestis*
Testes larger, minimum diameter 1/5 to 1/10 of hindbody length 6

6. Vitelline follicles extending into forebody only in ventral wall (Fig. 8.7); Australia; rare ..... *A. vitelliresiduus*
Vitelline follicles all in hindbody, none anteriad of adhesive gland 7

7. Hindbody wider than forebody; eggs large, 100–116μ long (Fig. 8.8); India; rare (*species inquirenda*) ..... *A. indicus*
Segments equal in width, or hindbody narrower than forebody 8

8. Eggs small, 87–92μ long; ovary at 25/100 of hindbody from anterior end; body large, 2.4–3.3 mm long (Fig. 8.9); Japan; rare (*species inquirenda*) ..... *A. japonicus*
Eggs larger, 90–115μ long; ovary at 20–40/100 of hindbody from anterior end 9

9. Body 2.7–3.3 mm long; oral sucker 3/4 size of acetabulum; ovary at 20–26/100 of hindbody; testes at 25–75/100 of hindbody; eggs 108–120μ long, few (Fig. 8.10); metacercarial cysts small, oval, 385μ by 200μ; Eurasia; frequent, usually in diving ducks ..... *A. fuligulae*
Body 1.9–2.5 mm long; oral sucker 2/3 size of acetabulum; ovary at 22–40/100 of hindbody; testes slightly more posterior, at 40–80/100 of hindbody; eggs 90–110μ long, few (Fig. 8.11); metacercarial cysts large, 540–1,000μ by 470–740μ; North America, Eurasia; frequent, in mergansers ..... *A. gracilis*

10. Forebody spherical; body up to 2.5 mm long (Fig. 8.12); Brazil; in muscovy duck (description inadequate) ..... *A. bdellocystis*
Forebody of different form: cup-shaped, funnel-shaped, or sacculate 11

11. Genital cone very large, 640–850μ by 420–500μ (retracted), 3/10 length of hindbody; body up to 5 mm long (Fig. 8.13); Australia; infrequent, in black swan ..... *A. intermedius*
Genital cone large, 440–660μ by 300–450μ (retracted), 1/3 or 1/4 length of hindbody; body up to 4.5 mm long (Fig. 8.14); North America, Eurasia; rare, in geese ..... *A. anseris*
Genital cone small or moderate, 145–470μ by 180–330μ (retracted) 12

12. Pharynx moderate, 78–104μ long by 57–92μ, over half the length of oral sucker; genital cone 310–400μ by 210–320μ (retracted); body up to 3.3 mm long (Fig. 8.15); Europe; infrequent, in swans ..... *A. fuhrmanni*
Pharynx small, weak, 33–85μ diameter, less than half or rarely 1/2 length of oral sucker 13

13. Genital cone moderate, 235–340μ by 180–245μ (retracted), 1/4 to 1/6 length of hindbody 14
Genital cone small, 145–280μ by 110–200μ (retracted), 1/5 to 1/7 length of hindbody 15

14. Eggs 100–125μ by 70–73μ; ovary at 10–18/100 of hindbody, in first fifth; body up to 3.2 mm long (Fig. 8.16); North America; infrequent, in all types of waterfowl ..... *A. canadensis*
Eggs 87–98μ long by 53–65μ; ovary at 20–36/100 of hindbody length; body up to 2.4 mm long (Fig. 8.17); Africa; rare, in *Thalassornis leuconotus* ..... *A. congolensis*

15. Ratio of length of worm to average diameter of testes equals 4.8–7; genital cone 145–200μ by 110–155μ (retracted); body up to 2.5 mm long (Fig. 8.18); Eurasia; probably common, in any type of waterfowl ..... *A. minor*
Ratio of length of worm to average diameter of testes equals 6.9–10.3; genital cone 150–280μ by 120–190μ (retracted); body 1.9–2.5 mm long (Fig. 8.19); North America; probably common, in normally any duck ..... *A. burti*

Descriptions: Dubois 1968; Dubois and Angel 1972; Dubois and Nassi 1977.

Genus *Cotylurus*

Family Strigeidae

Note: Infections obtained by ingestion of freshwater snails (*C. brevis*, *C. flabelliformis*, *C. cornutus*), leeches (*C. cornutus*, *C. strigeoides*), or fish (*C. erraticus*, *C. syrius*). Synonymy: *C. brandivitellata* synonym of *C. strigeoides; C. cucullus* and *C. strictus* synonyms of *C. platycephalus; C. orientalis* synonym of *C. syrius; C. variegatus* a misidentification.

1. Body large, 4–13 mm long; normally in posterior of intestinal tract of host—cloaca, large intestine, or posterior part of small intestine 2
   Body not over 5 mm long, generally smaller; in small intestine, usually the anterior 3

2. Testes with numerous small, crowded lobes; oral sucker deep within forebody; vitellaria entirely within hindbody (Fig. 9.1); in bursa of Fabricius or cloaca of host; North America, Eurasia; infrequent, normally in gulls . . . . . *C. platycephalus*
   Testes with two or three large lobes, directed posteriad; vitellaria extend into forebody to pharynx, in body wall and lobes of holdfast organ; oral sucker at anterior of forebody; acetabulum much larger than oral sucker; opening of forebody at right angle to forebody axis; eggs numerous (Fig. 9.2); in cloaca of host; Eurasia; infrequent . . . . . *C. raabei*

3. Vitellaria in both forebody and hindbody (see also *C. raabei*, *C. gallinulae hebraicus*) 4
   Vitellaria only in hindbody 6

4. Vitelline follicles barely penetrate base of forebody ventrally in projecting point; testes with three, sometimes four, elongate lobes, straight or sinuous, up to 700μ long (Fig. 9.3); North America, Eurasia; rare, normally in loons . . . . . *C. erraticus*
   Vitelline follicles extend into forebody walls and into lobes of holdfast organ 5

5. Vitellaria in walls of forebody, posterior to acetabulum; testes trilobed, lobes short, 300μ by 360μ; oral sucker and acetabulum subequal; opening of forebody oblique; uterus with 20–24 eggs (Fig. 9.4); North America, Europe; infrequent . . . . . *C. strigeoides*
   Vitellaria in lobes of holdfast organ; acetabulum larger than oral sucker; opening of forebody strongly oblique; forebody flexed strongly against hindbody, very muscular; posterior genital bulb 140–170μ in diameter, prominent muscular thickening at base on dorsal side; uterus with 30–60 eggs (Fig. 9.5); Australia; rare, in swan . . . . . *C. magniacetabulus*

6. Forebody opening at right angle to forebody axis; acetabulum in posterior of forebody (Fig. 9.6); Asia; infrequent (*Species inquirenda*) . . . . . *C. japonicus*
   Forebody opening oblique to longitudinal axis; forebody subglobular, or subhemispheric 7

7. Sporadic vitelline follicles in forebody, few; forebody flexed strongly toward hindbody; acetabulum equatorial in forebody; body up to 2–4 mm long; eggs 86–90μ long (Fig. 9.7); North America?, Eurasia; rare, normally in Rallidae (*Fulica*, *Gallinula*) . . . . . *C. gallinulae hebraicus*
   No vitelline follicles in forebody 8

8. Posterior end truncated; acetabulum larger than oral sucker; ovary near junction of segments, at 8–22/100 of hindbody length; body up to 1.8 mm long; rear testis 160–340μ long (Fig. 9.8); North America, Europe; infrequent . . . . . *C. brevis*
   Posterior end rounded, or sac-like with narrowed opening 9

9. Suckers subequal in size; body very small, up to 0.85 mm long; forebody strongly flexed, often against hindbody; posterior end rounded (Fig. 9.9); North America, Eurasia; frequent . . . . . *C. flabelliformis*
   Acetabulum larger than oral sucker; body over 2 mm long 10

10. Ovary in anterior of forebody, at 16–34/100; testes with two or three lobes, directed posterodorsad; eggs few or numerous 11
Ovary more posteriad, at 34–50/100 of hindbody; testes large, multilobed with large lobes; hindbody subreniform or sacciform, body up to 4 mm long; eggs numerous, large, 82–126μ long (Fig. 9.10); North America, Eurasia; rare, or reported erroneously in waterfowl, normally in terns ..... *C. pileatus*

11. Body up to 2.75 mm long; ovary at 16–34/100 of hindbody length; forebody subhemispheric, cup-shaped, attached excentrically (off center) to hindbody; eggs numerous, 81–110μ long (Fig. 9.11); cosmopolitan; very common, normally in Charadriiformes and perhaps Anseriformes, probably many waterfowl reports confused with *C. brevis* ..... *C. cornutus*
Body up to 3.5 mm long; ovary at 22–25/100 of hindbody length; forebody subglobular, attached concentrically to hindbody; testes large, second much longer, 500–568μ long; eggs few (13–21), large, 105–137μ long (Fig. 9.12); Eurasia; rare ..... *C. syrius*

Descriptions: Sudarikov 1959; Dubois 1968; Dubois and Angel 1972.

Genus *Austrobilharzia*

Family Schistosomatidae

Note: Infections obtained by direct invasion by larvae through skin, in marine waters (*A. terrigalensis; A. pricei* – unknown). Synonymy: *A. canadensis, A. chapini, A. manitobensis,* and *A. variglandis* all regarded as synonyms of *A. terrigalensis.*

1. Acetabulum sessile. Male: 28 testes, pre-equatorial; ceca unite about 1/5 body length from posterior; no cross ridges described in gynecophoric canal; oral sucker 125–150μ diameter, acetabulum 185μ diameter; body 5.3–6 mm long. Female: acetabulum 67–70μ diameter, oral sucker weakly developed; ovary over 1,300μ long, spiral with about 18 loops; body 9 mm long, 0.112 mm maximum width (Figs. 10.1, 10.2); North America; rare, in geese ..... *A. pricei*
Acetabulum stalked. Male: 12–20 testes, extending posteriad to middle of body; ceca unite about 1/3 body length from posterior; gynecophoric canal with transverse ridges with rows of spines; oral sucker and acetabulum both 200μ diameter; body 3.5–4.5 mm long. Female: body 3.2–5 mm long; acetabulum 65μ diameter, oral sucker 50μ; ovary 400–800μ long, spiraled with less than 10 loops, at about middle of body (Figs. 10.3, 10.4); North America, Oceania, Australia; infrequent ..... *A. terrigalensis*

Descriptions: Wetzel 1930; McLeod 1936; Stunkard and Hinchliffe 1952; Bearup 1956; Farley 1971.

Genus *Bilharziella*

Family Schistosomatidae

Note: Infections obtained by direct invasion by larvae through skin. Synonymy: *B. lali* synonym of *B. polonica; B. indica* suggested to be synonym of *B. polonica.*

1. Male: testes number 70–80; body 2.95 mm long, 0.375 mm wide; acetabulum 500μ from anterior end; esophagus 375μ long. Female: 1.8 mm long, 0.89 mm wide; ovary elongate, 155μ long, posterior (!) to reunion of paired ceca; esophagus 225μ long (Figs. 11.1, 11.2); India; rare ..... *B. indica*
Male: testes number 50–110; body 4 mm long, 0.5 mm wide; acetabulum 860μ from anterior end; esophagus about 500μ long. Female: 2.1 mm long, 0.25 mm wide; ovary elongate, anterior to union of paired ceca (Figs. 11.3, 11.4); Eurasia, Africa; very common ..... *B. polonica*

Descriptions: Skrjabin 1952; Baugh 1963; Khalifa 1972.

Genus *Dendritobilharzia*

Family Schistosomatidae

(Females only)

Note: Infections obtained by direct invasion by larvae through skin. Synonymy: *D. anatinarum* and *D. odhneri* synonyms of *D. pulverulenta*. Male of *D. asiaticus* unknown.

1. Ovary 2,800μ long, in seven coils; genital pore terminal at anterior end; eggs oval, 27–33μ long, with straight terminal spine; body 6 mm long (Fig. 12.1); India; rare (*species inquirenda*) ..... *D. asiaticus*

   Ovary 150–610μ long; genital pore 150–480μ from anterior end; newly laid eggs round, 49–65μ diameter, without spine; older eggs oval, larger; body 2.95–13.3 mm long (Figs. 12.2, 12.3); North America; Eurasia, North Africa; common ..... *D. pulverulenta*

Descriptions: Mehra 1940; Skrjabin 1952; Ulmer and Vande Vusse 1970.

Genus *Gigantobilharzia*

Family Schistosomatidae

(Males only)

Note: Infections obtained by direct invasion of larvae through skin. Synonymy: *G. suebica* synonym of *G. vittensis*. Females of three species not described. All measurements extremely variable, depending on degree of relaxation or contraction of body.

1. Cirrus sac and external seminal vesicle entirely between paired ceca (anterior to cecal reunion); genital pore just anterior to cecal reunion; one or no suckers present 2

   External seminal vesicle at least partly posterior to cecal reunion; genital pore at anterior end of gynecophoric canal; no suckers present 3

2. Oral sucker present; gynecophoric canal not seen (absent?); body length unknown, posterior end not seen; eggs 130μ by 100μ, elliptical with minute spine (Fig. 13.1); Europe; rare, perhaps normally in gulls or grebes ..... *G. monocotylea*

   No suckers; body extremely long, 83–165 mm long; gynecophoric canal 500–1,300μ long, just posterior to cecal reunion; esophagus 180–600μ long; testes number over 700; posterior end widened, truncate; female 30–35 mm long; eggs oval, about 100μ long (Fig. 13.2); North America, Eurasia; rare, normally in gulls ..... *G. acotylea*

3. External seminal vesicle partially posterior to cecal reunion; gynecophoric canal with or without transverse supporting bands 4

   External seminal vesicle entirely posterior to cecal reunion (reunion at junction of cirrus sac and seminal vesicle); transverse supporting bands present in gynecophoric canal 5

4. External seminal vesicle starts at about 100μ before cecal reunion; gynecophoric canal without transverse supporting bands, 180–210μ long; testes number 139–170; body 7.6–9 mm long (Fig. 13.3); Africa; rare ..... *G. plectropteri*

   External seminal vesicle starts about 200μ anterior to cecal reunion; gynecophoric canal 1,250μ long, with four to five transverse supporting bands; testes number 57; body 15 mm long (Fig. 13.4); Africa; rare ..... *G. nettapi*

5. Gynecophoric canal 86–153μ long, with one transverse supporting band or ridge; testes number 208–245; body 12–18 mm long (Fig. 13.5); Europe; rare, in duck from experimental infection, normally in gulls ..... *G. vittensis*

   Gynecophoric canal 1,400–1,500μ long, with 14–15 transverse supporting bands; testes number 280; body 21 mm long (Fig. 13.6); Africa; rare ..... *G. adami*

Gynecophoric canal 812–2,320μ long, with 55–60 transverse supporting bands; testes number 785; body 26 mm long; posterior end variable, rounded or expanded (Fig. 13.7); Europe; in duck from experimental infection, normally in gulls ..... *G. mazuriana*

Descriptions: Skrjabin 1952; Fain 1960; Reimer 1963*b*; Doenges 1964; Ulmer 1968; Khalifa 1974.

Genus *Jilinobilharzia*

Family Schistosomatidae

Note: Infections obtained by direct invasion by larvae through skin from fresh water.

1. Reunion of paired ceca in male at rear half of cirrus sac, toward middle of gynecophoric canal, anterior to genital pore, 490μ posterior to acetabulum; male longer than female, 3.85–4.545 mm and 1.98–2.865 mm long, respectively; testes number 83–132; cuticle without spines; gynecophoric canal 735–1,053μ long; eggs spindle-shaped, 156–256μ long (average 196μ by 57μ) (Fig. 14.1); China; rare ..... *J. crecci*

   Reunion of paired ceca in male at posterior end of gynecophoric canal, posterior to genital pore; male shorter than female, 2.3 mm and 3.4–4 mm long, respectively; testes number 50–70; gynecophoric canal perhaps about 200μ long; eggs spindle-shaped, 256μ long by 62μ (Fig. 14.2); Taiwan; rare, in domestic duck (not recorded since 1927) ..... *J. yokogawai*

Descriptions: Price 1929; Liu and Bai 1976.

Genus *Trichobilharzia*

Family Schistosomatidae

(Males only)

Note: Infections obtained by direct invasion by larvae through skin or mouth. Taxonomy difficult and disputed; eight species with only males described. Synonymy: *T. berghei* reported synonym of *T. anatina*, but retained in key; *T. maegraithi* synonym of *T. brevis;* correct name of *T. szidati* reported to be *T. parocellata*, but *szidati* retained in key; correct name for *T. elvae* disputed; *T. yokogawai* transferred to *Jilinobilharzia*. *T. adamsi* omitted, male not described, experimentally in domestic duck, natural host not known, North America. *T. kossarewi* omitted, description inadequate, cannot be keyed, in wild duck, Europe. No descriptions available for *T. jianensis* and *T. paoi*, omitted from key, both in domestic ducks, China.

1. Parasites of veins of nasal fossae of host 2

   Parasites of portal, mesenteric, or renal venous plexus of host 5

2. Cuticle spiny 3

   Cuticle appearing bare, any spines or tubercles visible only with oil-immersion lens 4

3. Cuticle with fine spines in tufts in testicular region; gynecophoric canal 410–420μ long, lined with long fusiform spines; external seminal vesicle 155μ long with 5–6 turns, starts 30μ behind acetabulum; eggs elongate, rhombic, with very small appendage at one pole; body 3.5 + mm long (Fig. 15.1); Africa; rare ..... *T. duboisi*

   Cuticle with fine spines evenly distributed; gynecophoric canal 250–325μ long, lined with spines; external seminal vesicle 120–220μ long, with five turns, starts about 50μ posterior to acetabulum; egg fusiform; body 21 mm long (Fig. 15.2); Africa; rare ..... *T. spinulata*

4. Cuticle covered with small tubercles; gynecophoric canal 219μ long; seminal vesicle 130μ long with five turns, starts just after acetabulum; eggs fusiform; body 6.1 + mm long (Fig. 15.3); Africa, India; rare, in domestic duck, originally described in ibis ..... *T. rodhaini*

   Cuticle smooth or covered with spines visible only by oil-immersion lens; gynecophoric canal 300–350μ long; seminal vesicle 250–340μ long, with four to six turns; egg fusiform; body 17–19 mm long (Fig. 15.4); Africa; rare ..... *T. nasicola*

5. Body very long, 12–50 mm long, maximum width 100–200μ; gynecophoric canal 920μ long; in geese and swans 6
Body small, 2.5–8 mm long, maximum width 150μ, generally less than 100μ; gynecophoric canal short or long 7

6. Body 33–50 mm long; gynecophoric canal 920μ long, posterior portion muscular, spines lining posterior end (Fig. 15.5); North America; common in swans, one record in geese ..... *T. brantae*
Body 12 + mm long; gynecophoric canal "short," muscular, lined with spines (Fig. 15.6); Eurasia; infrequent, in swans ..... *T. filiformis*

7. Gynecophoric canal 500–1,500μ long 8
Gynecophoric canal not over 500μ long 9

8. Gynecophoric canal 1,300–1,500μ long; cuticle spiny; cecal reunion 75–110μ posterior to acetabulum; external seminal vesicle very short, 90–110μ long with 2 turns; body 7–8 mm long (Fig. 15.7); Africa; rare ..... *T. anatina*
Gynecophoric canal 500–620μ long, pyriform; cuticle covered by small grains; cecal reunion at start of gynecophoric canal; external seminal vesicle 260–310μ long, with 3–4 spirals; body 5.1–6.8 mm long (Fig. 15.8); Africa; rare ..... *T. schoutedeni*

9. Esophagus enlarged at posterior end before cecal fork, often bulb-like 10
Esophagus not enlarged at posterior (or at least not so figured) 15

10. Cecal reunion located anterior to gynecophoric canal 11
Cecal reunion located within area of gynecophoric canal; canal shallow, 375μ long; body up to 3.7 mm long; North America; frequent ..... *T. querquedulae*

11. Cecal reunion just posterior to acetabulum, before seminal vesicle 12
Cecal reunion along area of seminal vesicle 13
Cecal reunion after seminal vesicle, at start of gynecophoric canal 14

12. Gynecophoric canal 60–100μ long, spines not reported in lining; body cuticle smooth; seminal vesicle 200–220μ long; body over 5 mm long (Fig. 15.9); North America; in duck from experimental infection, natural host unknown ..... *T. elvae*
Gynecophoric canal 100–190μ long, spines not reported in lining; body with fine spines?; seminal vesicle long, with 4 turns; body up to 7.5 mm long (Fig. 15.10); North America, Asia; infrequent ..... *T. physellae*
Gynecophoric canal not seen (inconspicuous?); seminal vesicle 590μ long, starts 170μ posterior to acetabulum; body to 5.5 mm or more long (Fig. 15.11); North America; in duck from experimental infection, natural host unknown ..... *T. stagnicolae*

13. Gynecophoric canal 92–288μ long, ventral surface spiny; seminal vesicle 143–463μ long, convoluted; body 2.5 mm or more long (Fig. 15.12); North America; in duck from experimental infection, natural host unknown (probably ducks) ..... *T. alaskensis*
Cecal reunion at anterior end of seminal vesicle; gynecophoric canal 220μ long, no spines described; seminal vesicle 200μ long, convoluted; body 3 mm long (Fig. 15.13); Europe; rare ..... *T. szidati*
Gynecophoric canal 300–450μ long, lined with spines; seminal vesicle 140–210μ long, convoluted; cuticle covered with spines; body 5.4–6.6 mm long (Fig. 15.14); North America; in duck from experimental infection, natural host unknown, but probably ducks ..... *T. oregonensis*

14. Cecal fork about 150μ anterior to acetabulum; gynecophoric canal 220–260μ long, spiny; body 6.4 mm long (Fig. 15.15); Southeast Asia; in duck from experimental infection, natural host unknown ..... *T. brevis*
Cecal fork just anterior to acetabulum; gynecophoric canal 166–249μ long, spiny; acetabulum with anterior cleft; body 5.7 mm long (Fig. 15.16); India; rare ..... *T. indica*

Cecal fork just anterior to acetabulum; seminal vesicle length more than half distance between acetabulum and gynecophoric canal; gynecophoric canal 212–345μ long, spiny; body 3.2–5.7 mm long (Fig. 15.17); North America; in duck from experimental infection, natural host unknown ..... *T. cameroni*

15. Gynecophoric canal less than 100μ long ..... *T. elvae*, see 12
Gynecophoric canal generally between 100 and 200μ long 16
Gynecophoric canal generally between 200 and 300μ long 19
Gynecophoric canal generally between 300 and 500μ long 23

16. Seminal vesicle short, extends less than half the distance between acetabulum and gynecophoric canal, some distance posterior to acetabulum, in spiral of 3–4 turns; gynecophoric canal 144μ long, spiny (Fig. 15.18); North America; rare ..... *T. burnetti*
Seminal vesicle long, extends more than half distance between acetabulum and gynecophoric canal 17

17. Cecal fork about halfway between anterior end and acetabulum, gynecophoric canal 144μ long, spiny; seminal vesicle in about six loops; body about 4 mm long (Fig. 15.19); North America; rare ..... *T. kegonsensis*
Cecal fork much closer to acetabulum than to anterior end 18

18. Cecal reunion just posterior to acetabulum, anterior to seminal vesicle ..... *T. physellae*, see 12
Cecal reunion at anterior end of gynecophoric canal, posterior to seminal vesicle ..... *T. indica*, see 14
Cecal reunion not seen (probably close to acetabulum); gynecophoric canal 125μ long, spiny; seminal vesicle long, in four to six loops; body 3.6 mm long (Fig. 15.20); North America; rare ..... *T. horiconensis*

19. Cecal fork just anterior to acetabulum (less than its diameter) 20
Cecal fork about 150μ anterior to acetabulum 21

20. Gynecophoric canal 257–306μ long, spiny; cecal reunion not seen; body 5.6 mm long (Fig. 15.21); North America; rare ..... *T. waubesensis*
Gynecophoric canal 166–249μ long, spiny; cecal reunion at start of gynecophoric canal ..... *T. indica*, see 14

21. Cecal reunion closely posterior to acetabulum, along seminal vesicle 22
Cecal reunion at start of gynecophoric canal; canal 220–260μ long, spiny ..... *T. brevis*, see 14

22. Cecal reunion at anterior end of seminal vesicle; gynecophoric canal 220μ long, no spines described ..... *T. szidati*, see 13
Cecal reunion at 1/3 length of seminal vesicle from its anterior end ..... *T. alaskensis*, see 13

23. Cecal fork 50–75μ anterior to acetabulum (about 1.5 to 2 times its diameter); cecal reunion at anterior of gynecophoric canal; canal 280–375μ long, spiny; seminal vesicle length less than 1/2 distance between acetabulum and gynecophoric canal; body 4.4–5.8 mm long (Fig. 15.22); Africa; rare ..... *T. berghei*
Cecal fork just before acetabulum (length of its diameter or less); cecal reunion at start of gynecophoric canal 24

24. Seminal vesicle length 1/2 or more of distance between acetabulum and gynecophoric canal 25
Seminal vesicle length less than half of distance between acetabulum and gynecophoric canal 26

25. Seminal vesicle length more than 1/2 distance between acetabulum and gynecophoric canal ..... *T. cameroni*, see 14
Seminal vesicle length about 1/2 distance between acetabulum and gynecophoric canal ..... *T. oregonensis*, see 13

26. Cecal reunion posterior to genital pore, within gynecophoric canal ..... *T. querquedulae*, see **10**
Cecal reunion just before gynecophoric canal **27**

27. Gynecophoric canal 320–510μ long, spiny; body 7–8 mm long, spiny (Fig. 15.23); North America, Eurasia; infrequent ..... *T. ocellata*
Gynecophoric canal 480–500μ long, spiny; body 3.8–5.5 mm long, spiny (Fig. 15.24); Eurasia; infrequent ..... *T. kowalewskii*

Descriptions: McLeod 1937; McLeod and Little 1942; McMullin and Beaver 1945; Neuhaus 1952; Skrjabin 1952; Wu 1953; Edwards and Jansch 1955; Fain 1955, 1956, 1959; Macy et al. 1955; Farr and Blankemeyer 1956; Bykhovskaya-Pavlovskaya and Ryzhikov 1959; Harkema 1960; Baugh 1963; Basch 1966; Tang and Tang 1976; Liu et al. 1977.

Genus *Cyclocoelum*

Family Cyclocoelidae

Note: Infections obtained by ingestion of freshwater snails. Synonymy: *C. halli* synonym of *C. brasilianum; C. capellum* synonym of *C. odeningi; C. lanceolatum* synonym of *C. vanelli; C. microstomum* and *C. pseudomicrostomum* synonyms of *C. mutabile*, or *C. microstomum* distinct; *C. neivai* synonym of *Neivaia cymbium*.

1. Gonads in triangle with ovary anterior to testes; testes contiguous; uterine loops bent posteriad in V from midline of body **2**
Gonads in triangle, ovary between testes or opposite one of them; testes separated from one another; uterine loops more or less horizontal, not in series of inverted V's **3**

2. Vitellaria in narrow bands lateral to ceca, confluent posteriorly; uterine loops extend across ceca; pharynx 330–550μ diameter; genital pore at cecal fork; eggs large, 250μ long; body 17–29 mm long (Fig. 16.1); North America, Eurasia, Africa, Australia; rare, normally in Charadriiformes ..... *C. vanelli*
Lateral bands of vitellaria not confluent posteriorly, narrow gap present; uterine loops overlap ceca, may extend across them; genital pore at level of middle or posterior end of pharynx; pharynx 165–298μ long; eggs 117–150μ long; body 14 mm long (Fig. 16.2); North America, Australia, Eurasia; rare, normally in Charadriiformes ..... *C. tringae*

3. Body less than 15 mm long **4**
Body large, 14–30 mm long **5**

4. Ovary at level of first testis, much smaller than testes; pharynx weak, 263–307μ diameter, vitellaria lateral, outside ceca, extend from anterior of cecal fork posteriad past level of testes to posterior vesicle, not confluent; body 11–14 mm long; eggs 130–161μ long (Fig. 16.3); North America, South America, Eurasia; rare, normally in Charadriiformes ..... *C. brasilianum*
Ovary at level of posterior of anterior testis, nearly equals size of testes; pharynx large, 380–550μ long by 620–740μ; vitellaria lateral, extracecal, extend from posteriad of cecal fork to level of second testis; body 9–11 mm long; eggs 129–154μ long (Fig. 16.4); Asia; infrequent ..... *C. odeningi*

5. Vitellaria extend from anteriad of cecal fork posteriad past level of testes, not confluent, along outer edge of ceca; ovary generally between testes; pharynx 200–490μ diameter; body 6–30 mm long (Fig. 16.5); North America, Eurasia, Africa; rare, normally in charadriid birds .. *C. obscurum*
Vitellaria extend from area of cecal fork to posterior of testes, not confluent, over ceca; pharynx very large, 800–1,270μ diameter; ovary generally opposite rear testis; body 14–22 mm long; North America, Eurasia; infrequent, normally in gruiform and charadriiform birds ..... *C. mutabile* – **6**

6. *C. mutabile* has been divided as follows: Genital pore at posterior border of pharynx; vitellaria in narrow compact marginal band, extending anteriad of cecal fork (Fig. 16.7); in Charadriiformes ..... *C. mutabile s. str.*

Genital pore anterior to pharynx; vitellaria in broad loose band over ceca and in marginal area, anterior ends posteriad of cecal fork (Fig. 16.6); in Rallidae (*Fulica*) ..... *C. microstomum*

Descriptions: Bashkirova 1950; Dubois 1959, 1965; Odening 1964; Macko 1965.

Genus *Hyptiasmus*

Family Cyclocoelidae

Note: *H. oculeus* infections obtained by ingestion of freshwater snails. Synonymy: *H. coelonodus*, *H. laevigatus*, *H. magniproles*, *H. theodori*, and *H. tumidus* all synonyms of *H. arcuatus; H. oculeus* reported to be synonym of *H. arcuatus; H. magnus* synonym of *Prohyptiasmus robustus.*

1. Transverse uterine loops extend across ceca only in posterior half of body, enclose rear gonads by lateral prolongations from in front of ovary 2
   Transverse uterine loops extend across ceca along entire length of body; latero-posterior prolongations meet posterior to cecal arc and rear testis (Fig. 17.1); Eurasia; rare ..... *H. oculeus*

2. Each testis with supplementary bean-shaped body on posterior side (Fig. 17.2); Europe; rare ..... *H. vigisi*
   No supplementary body attached to testes 3

3. Uterine loops confined to posterior third of body; ovary very close to or touching rear testis, testes 2,720μ apart (Fig. 17.3); Europe; rare ..... *H. witenbergi*
   Uterine loops fill space between ceca up to cirrus sac; ovary near but separate from rear testis (Fig. 17.4); Eurasia, Central America; common ..... *H. arcuatus*

Descriptions: Bashkirova 1950; Savinov 1960.

Genus *Ophthalmophagus*

Family Cyclocoelidae

Note: Source of infections unknown. Synonymy: *O. massinoi* and *O. nasicola* synonyms of *O. singularis; O. plectropteri* synonym of *O. magalhaesi.*

1. Body 5 mm long (immature); vitellaria extracecal, not extending posteriad of level of ovary; uterus intracecal, all anterior to ovary; testes in middle third of body, tandem (Fig. 18.1); Africa, South America; rare ..... *O. variolaris*
   Body 10 mm or more long; vitellaria overlapping ceca; uterine loops crossing ceca to lateral fields; testes in posterior half of body, more or less oblique to one another 2

2. Body 10 mm long; testes in posterior third of body, oblique or slightly oblique to one another; vitellarian fields confluent along posterior cecal arc; pharynx 200–350μ diameter (Fig. 18.2); North America, Eurasia; rare ..... *O. singularis*
   Body 15 mm long; testes in posterior quarter of body, slightly oblique; vitellaria extend posteriad to level of anterior testis; pharynx 870μ diameter (Fig. 18.3); Africa, South America; infrequent ..... *O. magalhaesi*

Descriptions: Bashkirova 1950.

Genus *Typhlocoelum*

Family Cyclocoelidae

Note: Infections obtained by ingestion of freshwater snails (*T. sisowi*). Synonymy: *T. americanum*, *T. flavum*, *T. gambense*, *T. obovale*, *T. reticulare*, *T. sarcidiornicola*, and *T. shovellus* synonyms of *T. cucumerinum; T. cymbium* and *T. hepaticum* synonyms of *T. sisowi; T. oculeus nomen nudum.*

1. Testes deeply lobed; lateral vitellarian fields unite in arc at posterior end (Fig. 19.1); cosmopolitan; very common, particularly characteristic of aythyine diving ducks ..... *T. cucumerinum*
   Testes not lobed, smooth margined 2

2. Testes kidney-shaped (Fig. 19.2); India; rare ..... *T. indicum*
   Testes round; vitellarian fields not uniting (Fig. 19.3) ..... *T. sisowi* – 3

3. Cecal diverticula rather prominent; vitellaria extend anteriad to pharyngeal region; cirrus sac large; cosmopolitan; very common ..... *T. sisowi sisowi*
   Cecal diverticula small, covered by uterine loops; vitellaria not extending anteriad of cecal fork; cirrus sac rather small (Fig. 19.4); India; rare ..... *T. sisowi acirratus*

Descriptions: Bashkirova 1950; Fotedar 1965; Jain 1966.

Genus *Leucochloridiomorpha*

Family Brachylaemidae

Note: Infections obtained by ingestion of freshwater snails. Synonymy: *L. macrocotyle* synonym of *L. constantiae; L. skrjabini* synonym of *L. lutea.*

1. Genital pore posterior to testes, almost terminal; cirrus sac posterior to testes; testes round 2
   Genital pore between testes, halfway between acetabulum and posterior end; cirrus sac at level of testes or anterior to them; testes oval or oblong 3

2. Cirrus sac nearly round, 132–172μ by 116–151μ, containing 25–30 hooks; esophagus 200–310μ long; cecal fork just anterior to acetabulum (Fig. 20.1); Europe; rare ..... *L. lutea*
   Cirrus sac 132μ long by 56μ, no hooks mentioned; no esophagus, cecal fork directly from pharynx, immediately anterior to acetabulum (Fig. 20.2); Europe–USSR; rare ..... *L. clangula*

3. Cecal fork 200μ anterior to acetabulum; cirrus sac oval; cuticle with papillae only at anterior end (Fig. 20.3); North America, Europe; infrequent ..... *L. constantiae*
   Cecal fork immediately anterior to acetabulum; cirrus sac oval; cuticle totally covered by papillae (Fig. 20.4); North America; in duck from experimental infection, natural host unknown ..... *L. papillata*

Descriptions: Skrjabin 1948; Shoemaker 1961; Voelker 1963; Khaziev 1963; Zinov'ev 1969.

Genus *Leucochloridium*

Family Leucochloridiidae

Note: Infections obtained by ingestion of freshwater marsh snails or brightly-colored sporocysts burst from snail tentacles. Classification confused, with little agreement. Synonymy: *L. actitis* synonym of *L. cyanocittae;* both *L. flavum* and *L. insigne* reported synonyms of *L. holostomum; L. insigne* also reported synonym of *L. heckerti.*

1. Cirrus sac nearly round, 120–150μ long by 180μ; testes almost round, smooth, same size as ovary; ovary almost round; vitellaria start at level of middle of oral sucker, entirely extracecal (Fig. 21.1); North America, Eurasia; rare ..... *L. cyanocittae*
   Cirrus sac oval 2

2. Testes slightly lobed, much larger than ovary; ovary irregularly shaped; vitellaria start at level of pharynx; cirrus sac 332–335μ long by 200–205μ (Fig. 21.2); North America, South America; rare ..... *L. flavum*
   Testes nearly round, smooth, subequal to ovary in size; ovary round; vitellaria start at about level of middle of oral sucker, extracecal; cirrus sac 150–230μ long by 80–170μ (Fig. 21.3); Eurasia, Africa?; rare ..... *L. insigne*

Descriptions: Witenberg 1925; McIntosh 1932; Larios Rodriguez 1943.

Genus *Gymnophallus*

Family Fellodistomatidae

Note: Infections obtained by ingestion of marine clams or polychaete annelid worms (two species). Synonymy: *G. dapsilis* synonym of *G. bursicola; Microphallus fusiformis* reported synonym of *G. rostratus* (name would then be *G. fusiformis*). Description of *G. rostratus* not available, characters used in key those of *fusiformis*.

1. Body small, less than 1 mm long (0.175–0.72 mm) 2
   Body larger, generally over 1 mm long (0.9–3 mm) 5

2. Suckers about equal size, ratio of diameters about 1:1; oral sucker less than 50μ diameter 3
   Oral sucker larger than acetabulum, ratio about 1.5:1; oral sucker 61–155μ diameter 4

3. Oral sucker diameter 36μ, acetabulum 34μ; ceca diverge at acute angle; body ovate, 0.23 mm long; testes oval, at level of acetabulum; ovary smaller; vitellaria in two separate masses at sides of acetabulum (Fig. 22.1); Europe; in duck from experimental infection, natural host unknown ..... *G. nereicola*
   Oral sucker 25–28μ diameter, acetabulum the same; ceca diverge at very obtuse angle; body fusiform, ends pointed, 0.175–0.22 mm long; testes oval, posterior to acetabulum; ovary between testis and acetabulum, but overlapping both; vitellaria two compact masses posterior to testes (Fig. 22.2); Europe; rare ..... *G. rostratus*

4. Oral sucker large, 116–155μ diameter, about 1.5 times larger than acetabulum, latter 63–106μ diameter; two vitellarian masses anterior to testes; vitellaria, testes, and ovary all at acetabular level, vitellaria overlapping anterior portion, testes overlapping level of posterior portion, ovary at right; ceca inflated, diverge at acute angle; body pear-shaped, 0.42–0.72 mm long (Fig. 22.3); Asia; rare ..... *G. skrjabini*
   Oral sucker 61–94μ diameter, acetabulum smaller, 50–81μ diameter, ratio about 1–1.4:1; vitellaria in compact mass (two masses or U-shaped in original figures) over acetabulum; testes opposite rear part of acetabulum, ovary to right; ceca inflated, diverge at about right angle; body ovate, 0.289–0.456 mm long (Fig. 22.4); Europe; rare ..... *G. gibberosus*
   Oral sucker 52–103μ diameter, acetabulum smaller, 38–84μ diameter, ratio 1.2–1.6:1; testes lateral to rear part of acetabulum, ovary anterior, vitellaria in two masses overlapping acetabulum, at about same level as testes; ceca very inflated; seminal vesicle bipartite; body pear-shaped, 0.343–0.695 mm long (Fig. 22.5); North America, Europe; infrequent ..... *G. somateriae*

5. Genital pore midway between suckers; genital atrium tubular, seminal vesicle bipartite; oral sucker about 1.5 times larger than acetabulum; testes posterior from level of rear margin of acetabulum; ovary to right and mostly anterior to acetabulum; two vitelline masses totally anterior to testes; body 1.4 mm long (Fig. 22.6); Europe; rare ..... *G. bilis*
   Genital pore at acetabular level or just anterior to it; ovary at level of middle of acetabulum or more posterior; vitellaria partially overlap level of testes 6

6. In relation to acetabulum: ovary at level of middle, vitellaria two irregular masses lateral and anterior, testes just posterior to rear margin; oral sucker 192μ diameter, about 1.2 times larger than acetabulum; body 1.33–1.36 mm long (Fig. 22.7); Asia; rare ..... *G. mollissima*
   Ovary more posterior, extending posteriad of acetabulum 7

7. Testes opposite, posterior to acetabulum by about twice its diameter, oval and slightly slanting toward one another; two vitellarian masses mostly posteriad of acetabulum; oral sucker 130–200μ diameter, about 1.2 times size of acetabulum; ceca short; body 0.9–1.5 mm long (Fig. 22.8); North America, Eurasia; infrequent ..... *G. bursicola*
   Testes not opposite, but in oblique position to one another, first testis at or just posterior to acetabulum 8

8. Ceca short, not reaching acetabulum, divergent at obtuse angle; first testis to left of acetabulum; two vitellarian masses at level of rear of acetabulum or more posterior; oral sucker 200μ diam-

eter, about 1.25 times size of acetabulum; body 0.9–1.1 mm long, ovate (Fig. 22.9); Greenland, Northern Europe; frequent ..... *G. choledocus*

Ceca long, reaching past acetabulum, divergent at acute angle; first testis posterior to acetabulum, at left; vitellaria in two compact masses of six to eight follicles each, mostly posterior to acetabulum; oral sucker 200–250μ diameter, about 1.25 times size of acetabulum; body 1.1–3 mm long, rather long-ovate (Fig. 22.10); North America, Eurasia; infrequent, normally in lariform birds ..... *G. deliciosus*

Descriptions: Morozov 1955, 1960; Brinkmann 1956; Rébecq and Prévot 1962; Reimer 1963*c*; Ryzhikov 1963*b*; Loos-Frank 1971; Bartoli 1972; Ching 1973*a*.

Genus *Lacunovermis*

Family Fellodistomatidae

Note: Infections obtained by ingestion of marine clams. Synonymy: *Meiogymnophallus macroporus* synonym of *L. macomae*.

1. Oral sucker without appendages, 2 to 2.5 times size of acetabulum; ceca inflated; acetabulum in posterior 1/6 of body, posterior to ovary and two vitelline masses, opposite the posterior testis; eggs small, 15–20μ long (Fig. 23.1); Asia; infrequent ..... *L. macrostomus*

   Oral sucker 1.3 to 2.5 times size of acetabulum, with two spine-like appendages or papillae; acetabulum more anteriad in relation to genital glands, at least opposite ovary and ventral or lateral to the two compact vitelline masses; eggs larger, 27–36μ long 2

2. Oral sucker about twice size of acetabulum; acetabulum rather anteriad, opposite ovary, anterior to testes; 30 to 100 eggs in uterus, 29–34μ long (Fig. 23.2); Eurasia; infrequent ..... *L. macomae*

   Acetabulum toward middle of genital glands, ovary overlapping anterior level, and testes overlapping posterior level; eggs fewer, 9–40 3

3. Oral sucker, 1.5 to 2.5 times size of acetabulum; eggs number 9–33, 26–34μ long (Fig. 23.3); North America; rare ..... *L. conspicuus*

   Oral sucker small, about 1.3 times size of acetabulum; ceca inflated; eggs number about 40, 27–30μ long (Fig. 22.4); Kamchatka; rare ..... *L. ceratostomus*

Descriptions: Morozov 1955; Tsimbalyuk and Leonov 1963; Ching 1965*a*; Loos-Frank 1970.

Genus *Meiogymnophallus*

Family Fellodistomatidae

Note: Infections obtained by ingestion of marine clams. Synonymy: *M. oidemiae* synonym of *M. minutus; M. macroporus* synonym of *Lacunovermis macomae*.

1. Body small, not over 0.28 mm long; oral sucker less than 60μ diameter; acetabulum less than 35μ diameter 2

   Body larger, 0.29–0.60 mm long; oral sucker 73–140μ diameter; acetabulum 48–70μ diameter 3

2. Testes posterior to acetabulum; ovary at level of acetabulum; vitellaria irregular mass over anterior half of acetabulum; ceca moderate, diverge at acute angle, do not reach level of acetabulum; oral sucker 1.2 times size of acetabulum; body 0.19–0.25 mm long; eggs number 30–100 in uterus, 18–20μ long (Fig. 24.1); Europe; infrequent ..... *M. minutus*

   Testes at acetabular level; ovary anterior to acetabulum; vitellaria in compact mass anterodorsal to acetabulum; ceca small, inflated, widely divergent; oral sucker about 1.7 times size of acetabulum; body 0.17–0.2 mm long; eggs very large, number 8–15 in uterus, 21–29μ long (Fig. 24.2); North America; rare ..... *M. multigemmulus*

3. Ovary oval, anterior and lateral to acetabulum; testes oval, at level of rear part of acetabulum; vitellaria two compact masses lateral to acetabulum; ceca inflated, divergent at obtuse angle, do not reach level of acetabulum; uterus with 150–250 eggs, mostly before acetabulum (Fig. 24.3); Europe; rare ..... *M. jamesoni*
Ovary round, overlapping rear margin of acetabulum; testes oval, posterior to acetabulum, nearly as large as ovary; vitellaria in irregular mass around acetabulum; ceca inflated, elongated, directed posteriad to rear edge of acetabulum or further; original figure shows 40 eggs in uterus, anterior to acetabulum (Fig. 24.4); Asia; rare ..... *M. minor*

Descriptions: Rhyzhikov 1963*a*; Ching 1965*a*; Bowers 1966; Bowers and James 1967.

Genus *Parvatrema*

Family Fellodistomatidae

Note: Infections obtained by ingestion of marine clams; *P. borealis* also in polychaete annelid worms.

1. Lateral ear-like projections or appendages, on oral sucker; oral sucker twice as large as acetabulum; ceca dilated, reach posteriad to level of rear of acetabulum; vitellaria in two irregularly oval masses overlapping acetabulum (Fig. 25.1); North America; in duck from experimental infection, natural host unknown ..... *P. borealis*
No lateral projections or appendages on oral sucker 2

2. Oral sucker and acetabulum nearly same size, 24μ and 19μ diameter, ratio of about 1.25:1; body 0.11–0.13 mm long; Eurasia; rare ..... *P. ovoplenus*
Oral sucker 2 to 4 times as large as acetabulum; body 0.11–0.67 mm long 3

3. Ovary larger than testes; testes rather oblique in arrangement, in area of acetabulum, in posterior 1/3 of body; vitellaria two irregular masses overlapping acetabulum; ceca inflated, widely divergent; oral sucker twice as large as acetabulum (Fig. 25.2); Europe; infrequent, perhaps normally in charadriiform birds ..... *P. affine*
Ovary smaller than testes or nearly same size; testes nearly opposite; vitellaria of compact masses of follicles 4

4. Testes at about level of acetabulum; ovary about same size as testes or slightly larger; vitellaria a single mass opposite ovary; ceca inflated, widely divergent, just reach seminal vesicle; oral sucker 2–3 times size of acetabulum; body large, 0.33–0.67 mm long (Fig. 25.3); Eurasia; in duck from experimental infection, natural host unknown ..... *P. timondavidi*
Testes well posterior to acetabulum; ovary smaller than testes; vitellaria in two reniform masses; oral sucker four times as large as acetabulum, 80μ and 18μ respectively; ceca not markedly inflated, extend posteriad to level of acetabulum (Fig. 25.4); North America; rare ..... *P. lintoni*

Descriptions: Morozov 1955; Stunkard and Uzmann 1958; James 1964; Bartoli 1965.

Genus *Acanthoparyphium*

Family Echinostomatidae

Note: Infections obtained by ingestion of marine and brackish-water snails. Synonymy: *A. tyosenense* synonym of *A. kurogamo*.

1. Vitellaria posterior, starting at level of rear testis; body 1.6–2.5 mm long; longest collar spines about 57μ long; eggs few (Fig. 26.1); Asia; rare, normal host probably shorebirds ..... *A. marilae*
Vitellaria starting at level of middle of acetabulum; body 2.2–3.1 mm long; largest collar spines 33–42μ long; eggs few (Fig. 26.2); Japan; rare ..... *A. melanittae*
Vitellaria start at level of ovary or just posterior 2

2. Esophagus short, 100–200μ long, less than diameter of acetabulum; collar spines small, 30–37μ long; body 1.4–1.9 mm long; eggs number 16, 71–79μ long (Fig. 26.3); Philippine Islands; rare, in duck from experimental infection, natural host unknown ..... *A. paracharadrii*
Esophagus longer than diameter of acetabulum; longest collar spines over 50μ long; body 1.9 mm or more long; over 30 eggs in uterus 3

3. Body large, 3–6.6 mm long; largest collar spines 75μ long; original figure shows 45 eggs in uterus (Fig. 26.4); North America, Asia, Australia; rare, normally in shorebirds ..... *A. spinulosum*
Body smaller, 1.9–3.85 mm long; largest collar spines 54–66μ long; about 30–60 eggs in uterus (Fig. 26.5); Asia; rare ..... *A. kurogamo*

Descriptions: Skrjabin and Bashkirova 1956; Velasquez 1964.

Genus *Curtuteria*

Family Echinostomatidae

Note: Source of infections unknown. Synonymy: *Himasthloides bonus* synonym of *Curtuteria grummti*.

1. Body club-shaped, rear widened, 1–3.2 mm long; cervical collar with 29 spines, up to 65μ long; uterus with about 80 eggs (Fig. 28.1); Europe; rare ..... *C. grummti*
Body elongate, slender, sides parallel, 1.3–2.15 mm long; cervical collar with 29 spines, up to 40μ long; uterus with about 12 eggs (Fig. 28.2); Europe; rare, normally in shorebirds ..... *C. numenii*

Descriptions: Odening 1963*a*; Reimer 1963*a*.

Genus *Echinochasmus*

Family Echinostomatidae

Note: Infections obtained by ingestion of freshwater fish (*E. beleocephalus*, *E. japonicus*, and *E. milvi*), once from frog tadpoles (*E. japonicus*). Description of *E. japonicus west-sibiricus* not available, so omitted from key; in duck from experimental infection; USSR.

1. Acetabulum near middle of body or more posterior 2
Fore margin of acetabulum 1/3 or less of body length from anterior end 6

2. Pharynx in notch of cephalic collar between ventral lobes; 22 collar spines, 26–58μ long; 4–7 eggs in uterus, 73–80μ long; body 1 65 mm long (Fig. 29.1); Eurasia, Africa; rare ..... *E. mordax*
Pharynx below notch between ventral lobes of cephalic collar 3

3. Cephalic collar spines number less than 24 (19–22) 4
Cephalic collar spines number 24 5

4. Cephalic collar spines number 19 in original figure, 21–35μ long; oral sucker about 1/2 size of acetabulum, equal in size to pharynx; uterus with one to two eggs, 78–84μ long; body 0.7–1.2 mm long (Fig. 29.2); North America, Asia; in duck from experimental infection, described from *Milvus* (kite) ..... *E. milvi*
Cephalic collar spines number 22, 25–37μ long; pharynx larger than oral sucker, acetabulum about twice as large; eggs very few, 87–90μ long; average length of body 1.16 mm (Fig. 29.3); North America; rare ..... *E. mergi mergi*

5. Cephalic spines 25–38μ long; oral sucker 1/3 size of acetabulum; acetabulum 132–154μ diameter; eggs few, 73–81μ long; body 0.7–0.9 mm long (Fig. 29.4); Eurasia, Africa; frequent, normally in herons ..... *E. beleocephalus*
Cephalic spines 14–28μ long; oral sucker 1/2 size of acetabulum; acetabulum 70–96μ diameter; eggs few, 77–90μ long; body 0.6–0.9 mm long (Fig. 29.5); Asia; rare ..... *E. japonicus*

6. Pharynx at least partially enclosed within notch between ventral lobes of cephalic collar 7
Pharynx primarily below notch in cephalic collar between ventral lobes 8

7. Cephalic collar spines number 24, 43–66μ long; 1/4 of body length anterior to acetabulum; acetabulum 264–297μ diameter; eggs 73–86μ long; anterior vitellaria at about level of middle of acetabulum; body 2.8–3.3 mm long (Fig. 29.6); Eurasia; infrequent, normally in grebes . . . . . *E. coaxatus*
Cephalic collar spines number 20, 37–79μ long; 1/3 of body length anterior to acetabulum; acetabulum 121–221μ diameter, anterior vitellaria at rear margin of acetabulum; body 1.1–1.5 mm long; eggs numerous, 67–79μ long (Fig. 29.7); Eurasia; infrequent . . . . . *E. dietzevi*

8. Anterior vitellaria at about posterior margin of acetabulum; cephalic spines number at least 22–24 (partially lost), 18μ long?; testes large, 280–320μ wide; ovary oblong-oval, 100μ long by 60μ; uterus short, with 12 eggs; eggs 92–100μ long; body 2.1 mm long (Fig. 29.8); Europe; rare . . . . . *E. mirus*
Anterior vitellaria posterior to acetabulum, at ovary or just anterior to it; cephalic spines number 22 or 24 9

9. Cephalic collar spines number 22; body 0.43–0.51 mm long; pharynx very large, longer and wider than oral sucker; testes transversely elongate, fill most of width between ceca; vitellaria in rear half of body, starting at or posterior to level of ovary; eggs few, 90–104μ long (Fig. 29.9); Europe; rare . . . . . *E. mergi palaearcticus*
Cephalic collar spines number 24, 55–64μ long; body 3.1–4.6 mm long; pharynx about size of oral sucker; testes round; anterior vitellaria anterior to ovary; eggs rather few, 68–81μ long (Fig. 29.10); Europe; rare, normally in herons . . . . . *E. amphibolus*

Descriptions: Skrjabin and Bashkirova 1956; Odening 1963*a*; Filimonova 1974.

Genus *Echinoparyphium*

Family Echinostomatidae

Note: Infections obtained by ingestion of freshwater snails (usually), or amphibia. Synonymy: *E. koidzumii* synonym of *E. recurvatum; E. cinctum* synonym of *Parechinostomum cinctum; E. petrowi* and *E. colchicus* synonyms of *Neoacanthoparyphium echinatoides. E. clerci, E. querquedulae, E. nordiana,* and *E. politus,* with dorsal spines of equal or nearly equal size, perhaps should be dropped from *Echinoparyphium,* but are retained in this key. The two latter species in particular, come close to *Echinostoma* in some other characteristics.

Echinoparyphium has cephalic collar with uneven total number of spines, 4–5 "corner" spines in each ventral lobe, 2–3 (rarely 4 or 6) unpaired lateral spines on each side, then two rows of alternating (paired) oral and aboral spines of unequal size around dorsal edge. Lost spines may be replaced by very small spines, not necessarily a species character. Most with body small, under 4 mm long; three with body medium to large, over 5 mm and up to 8.2 mm long.

Species not included in key, descriptions inadequate:

E. gizzardai. — 2.85-3 mm long; number of collar spines unknown (22 recorded, but some lost); collar spines 25–50μ long; cirrus sac reaches to middle of acetabulum; testes oval, just posterior to midline; vitellaria in two distinct lateral fields, starting at level of posterior of acetabulum; eggs 75–100μ long; India; rare.

E. minor. — Body 6.5 mm long; collar spines not described; cirrus sac anterior to acetabulum; testes oval, just posteriad to midline; vitellaria in two distinct lateral fields, starting posterior to acetabulum; eggs rather numerous, 97μ long; China; rare, in domestic duck.

E. longicirrus n. comb. — Body 5–7 mm long; collar spines reported as 34 (should be odd number), in double row of two sizes, larger spines 57μ long, corner spines number three; testes subquadrate and conical; vitellaria nearly confluent behind testes; eggs few (0–4); excretory bladder two-chambered; India; rare.

1. Collar spines number 37, testes smooth 2
Collar spines number 41 or more 8
Collar spines number 39, 42–50μ long; four very small corner spines; body 2.2 mm long; testes oblong, lobate, posterior to midline of body; vitellaria start posterior to acetabulum; eggs few, 95μ long (Fig. 30.1); Eurasia; rare . . . . . *E. sinorchis*

2. Corner spines of cephalic collar longer than other spines 3
Corner spines not the longest spines 7

3. Five corner spines in ventral lobe of collar 4
Four corner spines in ventral lobe of cephalic collar 6

4. Body small, 1–1.4 mm long; corner spines 34–37μ long, marginal spines 25–29μ long; vitellaria start at level of rear of ovary, nearly confluent behind testes; testes transversely oval, unequal; pharynx protrudes from rear of collar; one egg in uterus, 100–110μ long (Fig. 30.2); Asia; rare . . . . . *E. querquedulae*
Body larger, over 5 mm long; corner spines over 70μ long; vitellaria start near acetabulum; uterus with 25–30 eggs 5

5. Pharynx posterior to cervical collar; testes round or oval; eggs number about 25, 98–107μ long; body 5.8–9.6 mm long; corner spines 77–80μ long, marginal spines 64–77μ long (Fig. 30.3); Eurasia; infrequent . . . . . *E. nordiana*
Pharynx within posterior notch of cervical collar; testes oval; eggs about 33, 110–130μ long; body 5.2 mm long; corner spines 80μ long, marginal spines 70μ long (Fig. 30.4); Asia; rare . . . . . *E. politus*

6. Inner edge of acetabulum smooth; corner spines 47–55μ long, marginal spines 34–43μ long; body 2.2 mm long; vitellaria start at level just before ovary; pharynx within cephalic collar notch or extending below it; eggs few (three in original figure), 103μ long (Fig. 30.5); North America, Eurasia; frequent . . . . . *E. aconiatum*
Inner margin of acetabulum serrated; corner spines 48–56μ long, marginal spines 34–48μ long; body 1.7–2.2 mm long; vitellaria start at level midway between acetabulum and ovary, nearly confluent below testes; pharynx mostly below cephalic collar; eggs few (1–10), 80–96μ long (Fig. 30.6); Australia; in duck from experimental infection, natural host unknown . . . . *E. serratum*

7. Dorsal collar spines 74–100μ long, 5 corner spines 66–79μ long; testes variable, oval to reniform; pharynx mostly below cephalic collar; body medium sized, 5–7.1 mm long, 1.5 mm wide; vitellaria start just posterior to acetabulum, fields distinct; eggs 10–83, 100–110μ long (Fig. 30.7); China; rare, in domestic duck . . . . . *E. chinensis*
Dorsal collar spines 63–67μ long, corner spines 42–52μ long; pharynx posterior to cephalic collar; testes oval; body small, 2.67–4 mm long, 0.5–0.7 mm wide; vitellaria start by rear edge of acetabulum, fields distinct; eggs 10–25, 91–112μ long (Fig. 30.8); Europe; rare . . . . . *E. spiniferum*

8. Cephalic collar spines number 41 9
Cephalic collar spines number more than 42 11
Cephalic collar spines number 42 (should be odd number); eggs small, 53–79μ long, few (7); body 1.6–2.9 mm long, 0.88–0.9 mm wide; testes oval, slightly constricted in middle with lobate margins, just posterior to midline; cirrus sac small, 228μ diameter, extends about 1/3 length of acetabulum; vitellaria start posterior to acetabulum, fields confluent below testes; corner spines the longest spines (Fig. 30.9); India; rare . . . . . *E. bagulai*

9. Corner spines number 4; pharynx posterior to cervical collar; vitellaria not confluent behind testes 10
Corner spines number 5, 62–66μ long, 18μ wide; marginal spines up to 55μ long, 11μ wide; pharynx in notch in cervical collar; eggs number about 33, 100–103μ long; testes wide-oval; vitellaria confluent posteriorly; body 2–2.9 mm long (Fig. 30.10); Eurasia; infrequent . . . . *E. clerci*

10. Corner spines 67–74μ long, 13–15μ wide; marginal collar spines 40–67μ long, 5–11μ wide; eggs numerous, 90–108μ long; testes long-oval or bean-shaped; cirrus sac 360–380μ long, anterior to acetabulum; cecal fork 550μ anterior to acetabulum; seminal vesicle bipartite; body 2.9–3.5 mm long (Fig. 30.11); Eurasia; rare . . . . . *E. westsibiricum*
Corner spines 73–85μ long, 20–25μ wide; marginal collar spines 42–78μ long, 12–22μ wide; two single lateral spines on each side; cecal fork close to acetabulum; cirrus sac reaching middle

of acetabulum, 256–325μ long; testes oval; eggs few (14–18), 92–102μ long; body 2.9–3.5 mm long (Fig. 30.12); Taiwan; rare, in domestic duck ..... *E. anatis*

11. Collar spines number 43 12
Collar spines number 45 18

12. Body large, over 6 mm long 13
Body small, less than 5 mm long 14

13. Body large, elongate, 6–8.2 mm long, 0.9–1.2 mm wide; testes oblong-oval, constricted in middle or irregular, in rear 1/3 of body; eggs numerous, 90–94μ long; cirrus sac large, oblique in position, 847–880μ long; 5 corner spines 64–73μ long, marginal spines to 54μ long, 2–3 lateral spines (Fig. 30.13); West Siberia; rare ..... *E. aquaticum*
Body large, elongate, 6 mm long, 1 mm wide; testes round-oval; eggs few (7–9), 96–106μ long; cirrus sac medium, 213–267μ long, reaches middle or posterior of acetabulum; 5 corner spines 64μ long, marginal spines shorter, 2 lateral spines (Fig. 30.14); West Siberia; rare ..... *E. paracinctum*

14. Testes oval, smooth, symmetrical 15
Testes oval to elongate, form slightly irregular or constricted in middle 16

15. Testes touching, just posterior to midline, 410–510μ long; body 3 mm long, 0.55 mm wide; moderate number of eggs (30–45), 83–88μ long; cirrus sac large, oblique, seminal vesicle bipartite; with uterine seminal receptacle; 5 corner spines, 34–47μ long; marginal spines 38–42μ long (Fig. 30.15); Europe (Sardinia); in duck from experimental infection ..... *E. bioccalerouxi*
Testes in rear 1/3 of body, 190–230μ long; body 3.15 mm long; eggs few (20), 87–91μ long; cirrus sac small, 200–210μ long, reaches center of acetabulum; large seminal receptacle; 5 corner spines, 52μ long; marginal spines larger, up to 57μ long; 4 lateral spines (Fig. 30.16); North America, Africa; rare ..... *E. elegans*

16. Three single lateral collar spines, 5 corner spines 17
Two single lateral collar spines, 5 corner spines, up to 72μ long, marginal spines 30–57μ long; body 4.55 mm long, 0.96 mm wide; testes irregularly oval, in rear 1/3 of body; eggs numerous (75), 69–81μ long; cirrus sac small, position oblique, does not reach center of acetabulum (Fig. 30.17); Asia; rare ..... *E. syrdariense*

17. Testes long-oval, smooth, in rear half of body; eggs few (13), 90–120μ long; cirrus sac small, oval, seminal vesicle coiled; rarely with 45 collar spines; corner spines to 80μ long; vitellaria start just at rear of acetabulum; body 2.3–3.4 mm long, slender (Fig. 30.18); Malaysia; in duck from experimental infection, natural host unknown ..... *E. dunni*
Testes oval to oblong, slightly constricted in middle, in rear half of body; eggs rather numerous (15–90), 65–100μ long; cirrus sac small, oval, seminal vesicle single or bipartite; corner spines 41–77μ long, marginal spines 41–71μ long; vitellaria start midway between acetabulum and ovary, fields occasionally confluent; with uterine seminal receptacle; body 2.6–4.3 mm long, slender (Fig. 30.19); Africa; in duck from experimental infection, natural host unknown ..... *E. ralphaudyi*

18. Pharynx close to oral sucker, enclosed within deep notch in cephalic collar 19
Pharynx protruding posteriad of cephalic collar 20

19. Corner spines 5, 60–72μ long, marginal spines 36–58μ long; testes elliptic, just posteriad of midline; acetabulum small, 200–220μ long; eggs few (six in original figure), 84–86μ long; cirrus sac 163–238μ long, reaches middle of acetabulum; vitellaria start midway between acetabulum and ovary, nearly confluent posteriad; body 1.8–2.3 mm long (Fig. 30.20); North America, Eurasia; frequent ..... *E. baculus*
Corner spines 5, to 87μ long, marginal spines 59–66μ long; testes long-oval, just posteriad of midline; acetabulum 425μ long; eggs 22 in original figure, 96–103μ long; cirrus sac 340μ long,

reaches center of acetabulum; vitellaria start by rear edge of acetabulum, not confluent; body 2.8 mm long (Fig. 30.21); Asia; rare, normally in shorebirds ..... *E. mordwilkoi*

20. Three single lateral spines ..... *E. dunni* (see also No. 17)
Two single lateral spines 21

21. Rim of acetabulum with 17–25 indentations, acetabulum 280μ long; uterus short, eggs few (12–16), 103–110μ long; cirrus sac dorsal and left of acetabulum, extends along anterior 1/4 of acetabulum, seminal vesicle looped; testes oval, just posteriad of midline; with both seminal receptacle and uterine seminal receptacle; 5 corner spines, 55μ long; vitellaria start by rear edge of acetabulum, fields confluent; body 3.8–4 mm long (Fig. 30.22); North America, Asia; infrequent ..... *E. flexum*
Rim of acetabulum smooth, without notches or indentations 22

22. Eggs moderate in number (12–50), 87–100μ long; acetabulum 330–462μ long; cirrus sac rather short, 220μ long, seminal vesicle coiled; testes elliptical, smooth, in posterior 1/3; 5 corner spines (one very small), 63–69μ long, marginal spines 48–55μ long; vitellaria start posteriad of acetabulum, confluent; body 2.1–3.4 mm long, wide or slender (Fig. 30.23); Australia; rare ..... *E. ellisi*
Eggs few (7?), 90–110μ long; acetabulum 253–407μ long; cirrus sac 176–385μ long, reaches center of acetabulum; testes long-oval, in rear half of body; with uterine seminal receptacle; 5 corner spines 47–72μ long, marginal spines 39–64μ long; vitellaria start before ovary, nearly confluent; body 2–5 mm long, slender (Fig. 30.24); cosmopolitan; very common ..... *E. recurvatum*

Descriptions: Johnston and Angel 1949; Dollfus 1953; Skrjabin and Bashkirova 1956; Ahmed 1959; Ablasov and Chibichenko 1960; Jain 1961; Ku et al. 1964; Lie and Umathevy 1965*b*; Howell 1968; Lie et al. 1975; Fischthal and Kuntz 1976.

Genus *Echinostoma*

Family Echinostomatidae

Note: Infections obtained mostly by ingestion of freshwater snails (13 species), sometimes from amphibia (six species), and rarely from fish (two species). Synonymy: *E. luteoli nomen nudum; E. echinatum, E. echiniferum, E. mendax, E. multispinosus*, and *E. oxycephalum* (part) synonyms of *E. revolutum; E. elongata* and *E. hsui* synonyms of *E. asiatica; E. froelichii* and *E. oxycephalum* (part) synonyms of *Hypoderaeum conoideum*.

Collar spines should be an uneven number, even numbers given in some descriptions are doubtful. Some collar spines are often missing on older or poorly preserved specimens.

Species not included in key, descriptions inadquate:

E. katsuradai. — Description not available; in duck from experimental infection, natural host unknown; Japan.

E. echinocephalum. — Immature form, probably synonym of *E. revolutum;* 37 collar spines; body 2.7–2.3 mm long; Europe, Egypt.

E. minimus. — Collar spines 62–97μ long, number unknown, number of corner spines of ventral lobe of collar unknown; esophagus muscular, sinuous; cirrus sac small; testes nearly round; vitellaria lateral, from acetabulum to ends of ceca, not confluent; eggs few, 84–107μ long; India; rare.

1. Body small, 5 mm or less long 2
Body over 5 mm long 5

2. Cephalic collar small, 100μ wide; body 3.5–4.2 mm long; esophagus shorter than pharynx; pharynx longer than oral sucker; testes oval, 450–590μ long, middle of second testis at midline of body; eggs 75μ long (Fig. 31.1); China; rare, in domestic duck ..... *E. asiatica*
Cephalic collar larger, 200μ or more wide 3

3. Testes smooth, oblong to round 4
Testes lobate or irregular, 130μ by 150μ, beyond middle of body; collar spines number 34 (?), 50–75μ long; esophagus longer than pharynx; body 2.58 mm long; vitellaria start by middle of acetabulum (Fig. 31.2); India; rare ..... *E. chasma*

4. Middle of first testis at midline of body, testes oblong, slight constriction in middle, 400–520μ long; cirrus sac large, 260μ long; vitellaria start posterior to acetabulum; collar spines 35, 50μ long, 4 corner spines (Fig. 31.3); Asia; rare ..... *E. bhattacharyai indicus*
Testes posterior to middle of body, transversely oval, 42–63μ by 29–37μ; ovary lobed; cirrus sac 74–84μ long; 36 (?) collar spines, 33–37μ long, 4 corner spines; cephalic collar 190–210μ wide (Fig. 31.4); Asia; rare ..... *E. koisarensis*

5. Collar spines number less than 37 6
Collar spines number more than 37 21
Collar spines number 37, 5 corner spines on ventral lobes of cephalic collar; esophagus generally shorter than diameter of acetabulum, or about same length; eggs 99–132μ long; testes generally lobed – species confused; *E. paraulum*. *E. miyagawai*, and *E. robustum* have been declared synonyms of *E. revolutum*, but larval differences are reported; some authors suggest a complex of species with distinct larval characters, but with adults essentially indistinguishable 12

6. Collar spines number 27–28, 42–66μ long; 4 corner spines on each ventral lobe; acetabulum 500–620μ diameter; testes irregularly ovoid, at about middle of body; vitellaria start at level of ovary or just before, fields merge posterior to testes (Fig. 31.5); rare or erroneous in domestic duck, normally in mammals ..... *E. hortense*
Collar spines number 31 7
Collar spines number 32–36 8

7. Body 20.5 mm long; collar spines 75–110μ long; 3 corner spines; acetabulum 1,450μ by 1,300μ; testes lobed, irregular; vitellaria start posterior to acetabulum; eggs 90–108μ long (Fig. 31.6); Asia; rare ..... *E. anseris*
Body 5.8–8.64 mm long; collar spines 46–77μ long; 4 corner spines; acetabulum 800μ by 750μ; testes transversely oval or round, smooth; vitellaria start by rear edge of acetabulum; eggs 95–105μ long (Fig. 31.7); Europe, Africa; rare, typically in herons ..... *E. sudanense*

8. Collar spines number 32; body small, 5–9 mm long 9
Collar spines number 35–36; body small to moderate, 6–15 mm long 10

9. Collar spines 39–50μ long, 4 corner spines; oral sucker 144μ by 210μ; acetabulum 678–705μ diameter; vitellaria start posterior to acetabulum, fields expand behind testes; testes irregularly margined; body 5–8.8 mm long; India; rare ..... *E. crecci*
Collar small, size of spines unknown; oral sucker up to 500μ diameter; acetabulum 750–950μ by 840μ; vitellaria start beside acetabulum, not confluent; first testis oval, second pear-shaped or tricornered; pharynx powerful; ovary nearly as large as testes (Fig. 31.8); Africa; in duck from experimental infection, normally in coot ..... *E. fulicae*

10. Body moderate, 11–15 mm long; cephalic collar over 900μ wide 11
Body 6.3–6.8 mm long; cephalic collar 515μ wide; collar spines 60–100μ long, number 35, 4 corner spines; testes elongate, irregularly margined or constricted; vitellaria not confluent (Fig. 31.9); China; rare, in domestic duck ..... *E. pekinensis*

11. Collar spines 95–105μ long, number 35, 5 corner spines; cephalic collar 957μ wide; oral sucker 325–350μ diameter; acetabulum 1,125μ by 975μ; testes oval (Fig. 31.10); Eurasia; infrequent, normally in coot ..... *E. grandis*
Collar spines number 35–36, 79–160μ long; 5 corner spines; collar massive, 970–1,180μ wide; body spines massive; oral sucker 360–470μ diameter; acetabulum 970–1,180μ diameter; testes almost round (Fig. 31.11); Asia; rare, in domestic duck ..... *E. amurzetica*

12. Testes entire, smooth edged, oval 13
Testes lobed or lobate, notched, or constricted 14

13. Testes 281–932μ long; body 6–11.1 mm long; cephalic collar 403–576μ wide; collar spines 57–96μ long; oral sucker 180–292μ diameter (Fig. 31.12); Malaysia; in duck from experimental infection, natural host unknown ..... *E. audyi*

Testes 231–578μ long; body 3.65–7.8 mm long; cephalic collar 288–441μ wide; collar spines 54–89μ long; oral sucker 123–193μ wide; lateral bands of vitellaria perhaps merging posteriad (Fig. 31.13); South America; in duck from experimental infection, natural host unknown..... *E. barbosai*

14. Testes about as wide as long, deeply lobed..... 15

Testes elongate, lobed, bilobed or constricted in middle, to irregularly lobate (lobation can be induced by fixation)..... 16

15. Testes deeply lobed to rosette form, 362–1,048μ diameter; body 6–15 mm long; collar 780μ wide; collar spines 81–115μ long; vitellarian fields joined below testes; eggs 90–124μ long (Fig. 31.14); Southeast Asia, South America; rare, in domestic duck, normally in man or rodents ..... *E. lindoensis*

Testes three-lobed, sometimes rosette form, 840–1,000μ in diameter; body 9.3–13 mm long; cephalic collar 680–960μ wide; collar spines 83–132μ long; vitellarian fields unite below testes; eggs 88–107μ long (Fig. 31.15); Eurasia; common..... *E. miyagawai*

16. Lateral bands of vitellaria merge below testes (confluent)..... 17

Lateral bands of vitellaria remain separate below testes (not confluent)..... 18

17. Body 5.6–8 mm long; cephalic collar 360–515μ wide; collar spines 31–81μ long; oral sucker 140–326μ diameter; testes slightly lobed, slightly longer than wide, 402–1,030μ long by 309–670μ, second testis longer (Fig. 31.16); Africa; in duck from experimental infection, natural host unknown ..... *E. liei*

Body 9.7–10.8 mm long; cephalic collar well developed; oral sucker 210–250μ diameter; testes slightly longer than wide, more or less lobed, 670–1,300μ long, 400–600μ wide (Fig. 31.17); India; rare ..... *E. novum*

18. Corner spines of ventral lobes of cephalic collar 98–150μ long, massive..... 19

Corner spines of ventral lobes of cephalic collar moderate in size, 68–105μ long..... 20

19. Cephalic collar spines massive, corner spines over 100μ long (98–137—150?μ); oral sucker large, 340–484μ diameter; esophagus as long as acetabulum; testes lobed or bilobed, often transversely extended; body 6–9.8 mm long; eggs 81–103μ long (Fig. 31.18); North America, Eurasia; frequent..... *E. robustum*

Body long, 20.1 mm long; corner spines 146–175μ long, dorsal spines of collar 130–150μ long; collar 1,200μ wide; oral sucker 375–525μ diameter; testes oval, 1,100μ long, often constricted in middle; eggs 120–125μ long (Fig. 31.19); Azerbaijan; rare..... *E. stromi*

20. Cephalic spines large, corner spines 68–103μ long, longer than dorsal spines; body elongate, 10–22 mm long; collar 520–600μ wide; oral sucker 250–300μ diameter; esophagus shorter than acetabulum; eggs large, 99–132μ long; testes lobed, variable (Fig. 31.20); cosmopolitan; very common, in both birds and mammals ..... *E. revolutum*

Cephalic spines smaller; corner spines 45–60μ long, shorter than dorsal spines (70–80μ long); oral sucker 250–300μ diameter; esophagus short; testes lobed or constricted in middle; eggs 100μ long (Fig. 31.21); Eurasia; common ..... *E. paraulum*

21. Collar spines number 39–41..... 22

Collar spines number more than 41..... 23

22. Collar spines 39, 127–159μ long; 5 corner spines; body 18.8 mm long; cirrus sac 467μ long; testes long-oval, constricted in middle, first testis at midline; vitellaria start posterior to acetabulum; eggs 108μ long; Eurasia; infrequent..... *E. rufinae*

Collar spines 41, 28–53μ long; 4 corner spines, smaller than dorsal spines; body 9.7–10.9 mm long; cirrus sac very large, 750–1,017μ long; testes spheroid, deeply incised, just below midline of body; eggs 95–108μ long (Fig. 31.22); Eurasia; infrequent ..... *E. turkestanicum*

23. Collar spines number 45 24
Collar spines number 47 25

24. Pharynx about same size as oral sucker, 380–400μ and 320–380μ wide; testes oblong-oval, smooth, 1,340–1,520μ by 480–570μ; vitellaria start by rear edge of acetabulum; eggs 122–129μ long (Fig. 31.23); Eurasia; infrequent ..... *E. dietzi*
Pharynx smaller than oral sucker, 221μ by 289μ and 370μ diameters respectively; testes oblong-oval, very irregularly margined, 1,710–1,940μ by 460–680μ; vitellaria start below acetabulum; eggs 105–120μ long; cephalic collar spines 76μ long except internal corner spine (38μ); 6 corner spines (Fig. 31.24); Japan; in duck from experimental infection ..... *E. gotoi*

25. Medium size, 5–11.3 mm long; cephalic collar weak; oral sucker 140–270μ diameter; acetabulum 490–1,140μ diameter; testes lobed; eggs 84–114μ long (Fig. 31.25); North America, Eurasia; rare, normally in coots and gallinules ..... *E. chloropodis*
Body large, 11.6–18.6 mm long; cephalic collar large, 920–1,280μ wide; collar spines 88–132μ long; oral sucker 363–451μ diameter; acetabulum 1,160–1,720μ diameter; testes irregular, oblong-oval; eggs 107–132μ long (Fig. 31.26); Eurasia, Africa; rare, normally in gruiform birds ..... *E. sarcinum*

Descriptions: Porter 1938; Skrjabin and Bashkirova 1956; Ablasov and Iksanov 1959; Ablasov and Chibichenko 1960; Petrochenko and Egorova 1961; Lie 1964*b*; Lie and Umathevy 1965*a*; Lie and Basch 1966; Jeyarasasingam et al. 1972; Srivastava 1974.

Genus *Euparyphium*

Family Echinostomatidae

Note: Infections of *E. murinum* obtained by ingestion of freshwater snails.

1. Body 3.9–4.8 mm long; pharynx larger than oral sucker; cephalic collar 330–370μ wide, with 29 spines (probably incomplete count); oral sucker 66–99μ diameter; acetabulum 330–480μ diameter; 9–10 eggs in uterus (Fig. 32.1); Kamchatka; rare ..... *E. sobolevi*
Body 3.8–5 mm long; pharynx and oral sucker equal size; cephalic collar 200–290μ wide, with 45 spines; oral sucker 118–128μ diameter; acetabulum 349–395μ diameter; uterus with 23 eggs (Fig. 32.2); Asia; rare, in domestic duck and brown rat, natural host not definitely known ..... *E. murinum*

Descriptions: Skrjabin and Bashkirova 1956; Ryzhikov 1965.

Genus *Himasthla*

Family Echinostomatidae

Note: Infections obtained by ingestion of marine clams or snails, or polychaete annelid worms (*H. militaris*, rarely). *H. continua* reported once in duck in immature form; normally matures only in gulls, not included in key.

1. Cephalic collar spines number 29 2
Cephalic collar spines number 31, 65–70μ long; anterior margin of body serrate; vitellaria extend anteriad of rear margin of seminal vesicle; eggs 112μ long; body 9 mm long (Fig. 33.1); North America; rare ..... *H. incisa*

2. Vitellaria reaching anteriad to area of posterior end of seminal vesicle 3
Vitellaria extending anteriad only halfway between ovary and acetabulum; collar spines 34–48μ long; body 5.3–13.4 mm long; testes oval; eggs 80–96μ long (Fig. 33.2); North America, Europe; rare, normally in shorebirds ..... *H. leptosoma*

3. Middle of body appears annulated or pseudosegmented; vitellaria extending forward to posterior end of seminal vesicle; collar spines to 54μ long; body 3.6–12.7 mm long, slender; testes oval or elliptical; eggs large, 115–140μ long (Fig. 33.3); in duodenum of host; North America, Eurasia; rare, normally in gulls ..... *H. elongata*
Middle of body not annulated; vitellaria extending anteriad of posterior end of seminal vesicle 4

4. Testes elongate, smooth when preserved, indented in living worm; body 6.8–17 mm long, very slender; collar spines robust, 25 in continuous row from ventral lobe to lobe, 50–68μ long, two small spines out of line in each ventral lobe, 31–35μ long (Fig. 33.4); Europe; infrequent, normally in shorebirds and gulls ..... *H. militaris*
Testes oval, notched on margins; body 3–4.3 mm long, slender; collar spines in continuous row of 25 from ventral lobe to lobe, 54–62μ long, two small spines out of line in each ventral lobe, 26–32μ long (Fig. 33.5); North America; rare ..... *H. compacta*

Descriptions: Skrjabin and Bashkirova 1956; Stunkard 1960*b*; Loos-Frank 1967.

Genus *Hypoderaeum*
Family Echinostomatidae

Note: Infections obtained by ingestion of freshwater snails (three species) and sometimes amphibia (two species). Synonymy: *H. essexensis*, *H. magnocirrusa*, and *H. sinensis* synonyms of *H. conoideum*.

H. indica Gupta and Jahan 1976 (Indian J. Helminthol. 29: 57–72.)—obtained too late to include in key or references.

1. Pharynx with double muscular wall (wall of canal and outer wall, separated by cavity); 49 cephalic collar spines, 28μ long, 4 corner spines; ratio of suckers 1:5; cirrus sac small, not reaching middle of acetabulum, oblique, 942μ long; vitellaria joining behind testes; body 11 mm long (Fig. 34.1); Eurasia; infrequent ..... *H. skrjabini*
Pharynx with simple muscular wall 2

2. Cirrus sac 1,000μ or more long 3
Cirrus sac less than 800μ long; 47 or more collar spines 4

3. Cirrus sac 1,023μ long, extending past acetabulum; 43 collar spines, 51–60μ long; 5 corner spines; body 12.8 mm long; oral sucker-acetabulum size ratio 1:6 (Fig. 34.2); Eurasia; infrequent ..... *H. vigi*
Cirrus sac about 1,000μ long, extending below acetabulum; 49 (47–53) collar spines, 4 corner spines; body 6–12 mm long; oral sucker-acetabulum ratio 1:4 (Fig. 34.3); North America, Eurasia, Africa; characteristic ..... *H. conoideum*

4. Cirrus sac shorter than acetabulum; vitellarian fields not confluent below testes; esophagus equal or shorter than pharyngeal length 5
Cirrus sac shorter than acetabulum; vitellarian fields joining posterior to testes; esophagus longer than pharynx 7

5. Cirrus sac extending past middle of acetabulum; collar spines 49–54, mostly 50, 12–30μ long; 5 corner spines; cirrus 24μ long, broad posterior part with cuticular nodules; sucker ratio 1:3.3; body 6.1–10.2 mm long (Fig. 34.4); Malaysia; in duck from experimental infection, natural host unknown ..... *H. dingeri*
Cirrus sac overlapping acetabulum, not reaching middle 6

6. Collar spines number 47, 21–25μ long; cirrus sac 300μ long; cirrus smooth; sucker ratio 1:4; body 7.8 mm long (Fig. 34.5); Asia; rare ..... *H. microspina*
Collar spines number 51, 15–22μ long; 5 corner spines; cirrus sac 440–660μ long; sucker ratio 1:5; body 5.4–5.7 mm long (Fig. 34.6); Eurasia; infrequent ..... *H. gnedini*

7. Body slender, 7–7.75 mm long, 0.97–1.3 mm wide; ovary probably more than one acetabular

length posterior to acetabulum; vitellaria probably start more anteriad than midway between ovary and acetabulum; cirrus sac about 800μ long, almost as long as acetabulum; esophagus twice as long as pharynx (Fig. 34.7); India; rare ..... *H. mainpuria*

Body shorter, rather broad, 4.29–6.15 mm long, 1.43–1.9 mm wide; ovary rather close to acetabulum, less than one acetabular length distant; vitellaria start about midway between ovary and acetabulum; cirrus sac 600μ long, reaches middle of acetabulum; esophagus slightly longer than pharynx; 55 collar spines, 27–37μ long, 5 corner spines (Fig. 34.8); Asia; rare ..... *H. sobolevi*

Descriptions: Skrjabin and Bashkirova 1956; Khan 1962*b*; Lie 1964*a*; Alekseev 1965; Srivastava 1974.

Genus *Paryphostomum*

Family Echinostomatidae

Note: *P. radiatum* infections obtained by ingestion of freshwater fish or amphibians.

1. Body very large, 18.5 mm long; cephalic collar 715μ by 966μ wide; 35 collar spines, 84–109μ long, 6 corner spines; acetabulum over 1,000μ diameter; esophagus about 2 mm long; testes 5-lobed; eggs 101–109μ long; Asia; rare, described from snipe, perhaps normal host ..... *P. pentalobum*

   Body smaller, not over 8 mm long; collar less than 700μ wide; acetabulum less than 900μ diameter; esophagus less than 700μ long 2

2. Cephalic collar spines number 38–39, 4 or 5 corner spines, with extra large spine 44–58μ long, dorsal spines 9–14μ long; body covered anteriad with scale-like spines (Fig. 35.1); India; rare ..... *P. horai*

   Cephalic collar spines number 27 3

3. Oral sucker 130–200μ diameter; pharynx about same length as oral sucker; esophagus 150–300μ long; testes 3–6 lobed; corner spines 4, 93–180μ long (Fig. 35.2); Eurasia, Africa, Australia; rare, normally in cormorants ..... *P. radiatum*

   Oral sucker small, 88–99μ diameter; pharynx longer than oral sucker, 110–132μ long; esophagus 385–627μ long; testes 3-lobed; corner spines 4, 88–121μ long (Fig. 35.3); Eurasia; rare, probably normally in cormorants ..... *P. testitrifolium*

Descriptions: Skrjabin and Bashkirova 1956; Baugh 1950.

Genus *Petasiger*

Family Echinostomatidae

Note: Infections obtained by ingestion of freshwater oligochetes (*P. coronatus*) or fish (*P. megacanthum*). Synonymy: *P. grandevesicularis*, *P. longicirratus*, and *P. megacanthum* reported synonyms of *P. pungens*, but details not available, all retained in key; *P. skrjabini* reported synonym of *P. neocomense*, but retained here; *P. coronatus* reported in genus *Echinochasmus*, but retained here.

1. Cephalic collar spines number over 20, 3–5 spines in ventral lobes; vitellaria start by middle of acetabulum or more posteriad 2

   Cephalic collar spines number 19, 4 spines in each ventral lobe; vitellaria start at anterior margin of acetabulum or more anteriad 4

2. Cephalic collar spines number 23, 3 spines in each ventral lobe of collar; corner spines 55–73μ long, other collar spines 39–61μ long; testes oblique; vitellaria start at level of rear of acetabulum; body 0.98–1.74 mm long (Fig. 36.1); Asia; rare ..... *P. minutissimus*

   Cephalic collar spines number more than 23 3

3. Cephalic collar triangular, spines number 24, 3 spines in each ventral lobe, 19–54μ long; esophagus 200–240μ long; testes tandem, form differs; body 1.4–1.5 mm long (Fig. 36.2); Europe; rare ..... *P. coronatus*
   Cephalic collar spines 27; 5 spines in ventral lobes, 3 corner spines 53–67μ long, other spines 38–54μ long; esophagus 400μ long; testes oblique, tandem, overlapping; body 1.28 mm long (Fig. 36.3); Eurasia; rare ..... *P. jubilarum*

4. Vitellaria start at level of fore margin of acetabulum; 4 corner spines 104–112μ long, other collar spines 44–86μ long; testes obliquely tandem; body 1.28–1.31 mm long (Fig. 36.4); Asia; rare ..... *P. longicirratus*
   Vitellaria start anterior to acetabulum 5

5. Esophagus short (shorter than pharynx); vitellaria touching in arc along cecal fork anterior to acetabulum; angle spines 50–96μ long, other collar spines 24–66μ long; testes opposite or oblique to one another, unequal; eggs 81–90μ by 54–58μ, few; body 0.6–1.75 mm long (Fig. 36.5); Asia; accidental, normally in grebes ..... *P. grandevesicularis*
   Esophagus longer (220–275μ long) 6

6. Corner spines 4, 113–122μ long, other collar spines 86–97μ long; testes tandem, transversely elongate; eggs 97μ long, number up to 12; body 1.6–1.78 mm long (Fig. 36.6); North America, Eurasia; rare, normally in grebes ..... *P. megacanthum*
   Spines smaller, 4 corner spines 88–110μ long, other collar spines 55–66μ long; testes apparently opposite; eggs 66–77μ long, number up to seven; body 1.28–1.78 mm long (Fig. 36.7); Europe; rare, normally in grebes ..... *P. skrjabini*

Descriptions: Skrjabin and Bashkirova 1956.

Genus *Stephanoprora*

Family Echinostomatidae

Note: Infections obtained by ingestion of freshwater fish. Synonymy: *S. spinosus* synonym of *S. spinulosa*.

1. Eggs larger than ovary, few (two to five) 2
   Eggs smaller than ovary, usually more than four 3

2. Testes oval; eggs 80–86μ long, number four to five; body 1.35 mm long; cephalic collar spines 22, 16–19μ long (Fig. 37.1); Europe; rare ..... *S. gracilis*
   Testes round; two eggs 77–80μ long, almost round; body 4.24 mm long; cephalic collar spines 22, 22–28μ long; vitellaria essentially confluent posterior to testes (Fig. 37.2); Iceland; rare, in fish-eating birds ..... *S. pseudodenticulata*

3. Testes transverse oval or elliptical 4
   Testes longitudinally oval; body slender, elongate 5

4. Less than 1/3 of body length posteriad to testes, filled with two masses of vitellaria; body short and club-shaped, or elongate, 0.7–2.7 mm long; eggs few, four to seven, 60–88μ long; testes dissimilar, first transversely elongate, second triangular; collar spines 34–50μ long; pharynx longer than oral sucker (Fig. 37.3); North America, Eurasia, Africa; infrequent, in fish-eating birds ..... *S. spinulosa*
   More than 1/3 of body length posterior to testes, filled by two masses of vitellaria; body elongate, 2.1–2.5 mm long; eggs at least 20, 63–80μ long; testes transversely oblong; collar spines 33–51μ long (Fig. 37.4); South America; in duck from experimental infection, normally in shorebirds ..... *S. paradenticulata*

5. Eggs numerous, 88–110μ long; body elongate, 4.4–5.9 mm long; collar spines 47–60μ long; testes oval, touching; ovary 110–154μ diameter (Fig. 37.5); North America, Eurasia, Africa; infrequent, normally in lariform birds ..... *S. denticulata*

Eggs number 7–28, 84–94μ long; body 3.7–5.2 mm long; collar spines 70–93μ long; testes oval, slightly separated (Fig. 37.6); North America, Eurasia, Africa; infrequent, normally in lariform birds ..... *S. pseudoechinata*

Descriptions: Skrjabin and Bashkirova 1956; Odening 1963*a*; Nasir and Rodriguez 1969.

Genus *Cloacitrema*

Family Philophthalmidae

Note: Infections of *C. philippinum* obtained by ingestion of brackish-water snails. Synonymy: *C. marilae* synonym of *C. ovatum*.

1. Uterus with preacetabular coils; acetabulum 1.6 times diameter of oral sucker; body oval, 1.6–3.5 mm long (Fig. 38.1); Asia; infrequent ..... *C. ovatum*
   Uterus entirely posterior to acetabulum; acetabulum about twice diameter of oral sucker; body spatulate, 1–1.5 mm long (Fig. 38.2); Philippine Islands; in duck from experimental infection, natural host unknown ..... *C. philippinum*

Descriptions: Yamaguti 1935; Skrjabin 1947; Velasquez 1969*b*.

Genus *Philophthalmus*

Family Philophthalmidae

Note: Metacercariae encysted on solid materials in fresh or marine waters. Synonymy: *P. cupensis*, *P. hovorkai*, and *P. posaviniensis* synonyms of *P. gralli*; *P. peteri nomen nudum*.

1. Vitellaria extend 1/2 or less of distance toward acetabulum from first testis 2
   Vitellaria extend well over half the distance between first testis and acetabulum 3

2. Vitellarian fields short, four to six follicles on each side, from middle of ovary anteriad (35–60/100 of distance to acetabulum); acetabulum diameter about twice transverse diameter of oral sucker; cirrus sac not extending posteriad to acetabulum; testes round to lobed; body 1.8–5.5 mm long (Fig. 39.1); North America; experimental infection in swan, normally in herons and Charadriiformes ..... *P. hegeneri*
   Vitellarian fields short, extend anteriad from first testis about halfway to acetabulum; acetabulum about 1.5 times diameter of oral sucker; cirrus sac extending well posteriad of acetabulum; testes irregularly shaped, smooth; body 1.7–3 mm long (Fig. 39.2); Philippine Islands; rare, in domestic duck ..... *P. rizalensis*
   Vitellaria in about six masses, extending less than halfway from testes to acetabulum; acetabulum 1.5 times diameter of oral sucker; cirrus sac extending posteriad of acetabulum; testes smooth, transversely elongate; body 4.14 mm long (Fig. 39.3); USSR; rare, normally in terns ..... *P. skrjabini*

3. Cirrus sac and seminal vesicle not extending posteriad of acetabulum 4
   Cirrus sac and seminal vesicle extending posteriad of acetabulum 5

4. Proboscis-like structure present, extending anteriad from acetabulum on ventral side; ovary larger than testes; pharynx almost equal to oral sucker in size; testes lobed, tandem (Fig. 39.4); Asia; rare ..... *P. proboscidus*
   No proboscis present; ovary 1/2 size of testes; pharynx about 3/4 size of oral sucker; testes variable in shape, smooth, tandem; acetabulum much larger than oral sucker (Fig. 39.5); Asia; rare, in domestic duck ..... *P. sinensis*

5. Vitellaria intercecal in posterior portion 6
   Vitellaria entirely extracecal or only overlapping ceca 7

6. Acetabulum about 1.2 times larger than oral sucker; vitellaria extend at least 80–85/100 of distance between testes and acetabulum; seminal vesicle extends well to rear of acetabulum, cirrus sac in transverse position or not; testes tandem or oblique, round to slightly flattened, lobed or not; body 3.3–4 mm long; cuticle spiny (Fig. 39.6); North America, Eurasia, Oceania (Hawaii); infrequent ..... *P. gralli*

Acetabulum about 1.1 times diameter of oral sucker; pharynx slightly smaller; vitellaria extend about 90/100 of distance between testes and acetabulum, mostly intercecal or lying over ceca; seminal vesicle extends well to rear of acetabulum; testes large, tandem, first testis round, second rather triangular; ovary round, small; body 5.2 mm long (Fig. 39.7); Asia; infrequent ..... *P. nyrocae*

Acetabulum about 1.2 times diameter of oral sucker; pharynx about 3/4 width of oral sucker; cirrus sac extending far posteriad of acetabulum; vitellaria tubular, posterior half intercecal, extend from rear testis to acetabulum; testes large, tandem, slightly flattened; ovary small, round; body 3.6–6.5 mm long; cuticle smooth; Asia; infrequent, in domestic duck ..... *P. anatinus*

7. Testes somewhat irregular in shape, smooth, oblique to one another; ovary small, 2/3 size of testes; body 3.23 mm long, without spines?; acetabulum about 1.5 times size of oral sucker; oral sucker about 1.3 times size of pharynx; eggs 84μ long (Fig. 39.8); Eurasia; rare, in domestic duck ..... *P. muraschkinzewi*

Testes lobed, tandem; ovary small, round, 1/3 size of testes; body 5–7 mm long, without spines; acetabulum about 1.4 times size of oral sucker; pharynx and oral sucker about same size; eggs 100μ long (Fig. 39.9); Eurasia, Africa; rare ..... *P. nocturnus*

Descriptions: Sugimoto 1928; Hsü and Chow 1938; Skrjabin 1947; Richter et al. 1953; Ching 1961*a*; Buša 1962; Oshmarin 1963, 1970; Penner and Fried 1963.

Genus *Psilochasmus*

Family Psilostomatidae

Note: *P. oxyurus* metacercariae encysted on surface of freshwater snails. Synonymy: *P. agilis* and *P. japonicus* synonyms of *P. oxyurus; P. alii, P. indicus*, and *P. longicirratus* reported synonyms of *P. oxyurus*, but retained in key; *P. lecithosus* synonym of *Hypoderaeum conoideum*.

1. Sphincter-like formation in anterior part of pharynx; sphincter-like bundles at opening of acetabulum (Fig. 40.1); Asia; rare, in domestic duck ..... *P. sphincteropharynx*

Pharynx and acetabulum normal, without sphincters 2

2. No esophagus, cecal fork at pharynx; genital pore just above acetabulum, well posterior to cecal fork; cirrus sac extends to ovary, 1,550μ long; eggs 100μ long; Eurasia; infrequent ..... *P. skrjabini*

Esophagus present 3

3. Genital pore anterior to cecal fork; lateral vitelline fields unite anteriorly and posteriorly; cirrus sac does not reach ovary; eggs 80–96μ long, number three (Fig. 40.2); India; rare ..... *P. indicus*

Genital pore at or just posterior to cecal fork; vitelline fields unite only posteriorly or not at all; eggs number more than three in uterus 4

4. Esophagus inflated, half as wide as long, 700–940μ long, 500–620μ wide; cirrus sac extends to ovary; genital pore lateral to cecal fork; eggs 110–130μ long, numerous (Fig. 40.3); India; rare ..... *P. alii*

Esophagus narrow, width much less than 1/2 length; genital pore median 5

5. Ovary anterior to midline; vitellaria not uniting posteriad; cirrus sac extending to rear edge of ovary, 1,292–1,302μ long; testes large, unequal, 653–884μ long; 5–26 eggs in uterus, 116–124μ long (Fig. 40.4); North America, Eurasia; common ..... *P. longicirratus*

Ovary at midline or just posterior to it; vitelline fields uniting at posterior end 6

6. Cirrus sac sometimes just reaching ovary, 487–1,000μ long; ovary just anterior to testes; esophagus long; testes small or large, unequal; 30–40 eggs in uterus, 81–107μ long (Fig. 40.5); North America, South America, Eurasia, Africa; very common ..... *P. oxyurus*
Cirrus sac extending nearly to ovary; testes slightly notched, small, 458–664μ long; ovary 386μ anterior to testes; eggs few, 90–142μ long; esophagus stout, 439–568μ long, 110–174μ wide (Fig. 40.6); India; rare ..... *P. singhi*

Descriptions: Skrjabin 1947; Jaiswal 1957; Gupta 1958; Oshmarin 1970; Jaiswal and Humayon 1971.

Genus *Psilorchis*

Family Psilostomatidae

Note: Source of infection unknown.

1. Esophagus absent, cecal fork just posterior to pharynx; ceca inflated at fork; preoral lobe present (sometimes like rudimentary collar); body 4.95–10.2 mm long; acetabulum five times larger than oral sucker; oral sucker 1.25 times wider than pharynx (Fig. 41.1); India; rare ..... *P. udaipurensis*
Esophagus present, 125–360μ long; anterior portion of ceca not inflated; no preoral lobe reported 2

2. Acetabulum about three times larger than oral sucker, 650μ by 550μ; oral sucker twice width of pharynx; body 6.6 mm long; esophagus 125μ long (Fig. 41.2); India; rare ..... *P. ajgainis*
Acetabulum five times larger than oral sucker, 1,080–1,140μ diameter; oral sucker and pharynx about equal width; body 11.4 mm long; esophagus 360μ long (Fig. 41.3); India; rare ..... *P. seekhpari*

Descriptions: Skrjabin 1947; Jain 1968; Sharma 1977.

Genus *Psilostomum*

Family Psilostomatidae

Note: Metacercariae of *P. brevicolle* in marine clams or snails. Synonymy: *P. cygnei* synonym of *Psilotrem simillimum*.

1. Pharynx larger than oral sucker; vitellaria start at level of rear edge of acetabulum; eggs in uterus number 27, 93–95μ long; body 2.2–2.7 mm long, posterior end conical; no esophagus (Fig. 42.1); Asia; rare ..... *P. anserinum*
Pharynx smaller than oral sucker; posterior end rounded 2

2. Acetabulum about equal in size with oral sucker; vitellaria start shortly below level of acetabulum; cirrus sac extends below acetabulum, 650μ long; eggs number 50 in uterus, 112μ long (Fig. 42.2); Eurasia; infrequent ..... *P. brevicolle*
Acetabulum twice or more larger than oral sucker 3

3. Body 0.5–0.6 mm long; vitellaria start at level of genital pore, before acetabulum; cirrus sac extends to center of acetabulum; testes diagonal or oblique; ovary opposite first testis; eggs 85–90μ long, few (Fig. 42.3); North America; rare ..... *P. marilae*
Body 2.3–2.8 mm long; vitellaria start at rear edge of acetabulum; cirrus sac extends to ovary; testes tandem; ovary anterior to testes; eggs number 30–50 in uterus, 96–112μ long (Fig. 42.4); Asia; rare ..... *P. borealis*

Descriptions: Skrjabin 1947; Oshmarin 1963; Ryzhikov 1963*a*.

Genus *Psilotrema*

Family Psilostomatidae

Note: Metacercariae (*P. oligoon, P. simillimum*) encysted on surface of snail shells or vegetation in fresh water. Synonymy: *P. spiculigerum* and *P. tuberculata* synonyms of *P. oligoon.*

P. creccai Gupta and Jahan 1977 (Indian J. Helminthol. 29:46–56) – obtained too late to include in key or references.

1. Pharynx much larger than oral sucker; no esophagus; acetabulum about 2–3 times size of oral sucker; vitellaria posterior to testes, extend forward laterad to level of ovary ..... *P. simillimum* – 2
   Pharynx smaller than oral sucker 3

2. Acetabulum strongly protruding anteriad, 398–453μ long, 200–291μ diameter; uterus with 1–15 eggs (Fig. 43.1); Europe; rare, in domestic duck ..... *P. simillimum swerinensis*
   Acetabulum less developed, up to 385μ long; uterus with 5–7 eggs (Fig. 43.2); Eurasia; infrequent ..... *P. s. simillimum*

3. Acetabulum from about same size to 1.2 times as large as oral sucker; vitellaria start at level of fore edge of acetabulum; no esophagus; eggs two to eight in number, 85–110μ long (Fig. 43.3); Eurasia; infrequent ..... *P. oligoon*
   Acetabulum about 1.5–3 times as large as oral sucker 4

4. Vitellaria start at level of first testis; testes close together in middle of body; eggs number one to four, 90μ long (Fig. 43.4); Asia; infrequent ..... *P. mediopora*
   Vitellaria start at level of middle of acetabulum; testes fill third quarter of body (or more) 5

5. Body 1.8 mm long; testes large, nearly round; ovary over 100μ long 6
   Body 0.86–1.02 mm long; testes transversely oval, 130μ long; ovary 86μ long; one egg in uterus, 82μ long (Fig. 43.5); Asia; infrequent ..... *P. brevis*

6. Testes fill third quarter of body, 220–260μ long; ovary 190–250μ diameter; eggs few (seven?), very large, 112μ long (Fig. 43.6); Asia; rare ..... *P. acutirostris*
   Testes fill most of posterior half of body, 315–360μ long; ovary 120μ long; eggs few (four?), 62–80μ long (Fig. 43.7); India; rare ..... *P. nettapusi*

Descriptions: Skrjabin 1947; Oshmarin 1963; Graefner 1965; Gupta and Gupta 1977.

Genus *Catatropis*

Family Notocotylidae

Note: Metacercariae encysted on surface of snails, vegetation, or invertebrates, in fresh water.

C. appendiculata omitted; numerous short diverticula along intestinal ceca; no other characters known; Venezuela; rare.

1. Only midventral keel present, no lateral rows of papillae; cirrus sac reaches middle of body; length of metraterm about equal to cirrus sac (Fig. 44.1); North America; in chick (not duck) from experimental infection, natural host unknown ..... *C. johnstoni*
   Midventral ridge with row of separate papillae on each side 2

2. Genital pore anterior to intestinal bifurcation 3
   Genital pore posterior to or at level of intestinal bifurcation 6

3. Cirrus sac extends more than 1/3 length of body from anterior end (to 44/100); metraterm 1/2–2/3 as long as cirrus sac; esophagus short, 70μ long; 9–11 papillae in each lateral row (Fig. 44.2); North America; rare ..... *C. pricei*

Cirrus sac extends less than 1/3 body length from anterior end; metraterm equal to or longer than cirrus sac; esophagus 130–260μ long 4

4. Testes 750–990μ long; 10–12 papillae in lateral rows; ceca with small diverticula on outer side; body 4.2–4.6 mm long (Fig. 44.3); India; rare, in domestic duck ..... *C. indicus*
Testes not over 560μ long; ceca without diverticula; body smaller 5

5. Uterine loops total 15–19, 1–2 previtelline; 10 papillae in each lateral row; oral sucker 70μ by 86–90μ; vitellaria start at 44/100 body length from anterior end (Fig. 44.4); India; rare ..... *C. rauschi*
Uterine loops number 19, 5–6 previtelline; 7–9 papillae in lateral rows; oral sucker 110–115μ diameter; vitellaria start at midline of body (Fig. 44.5); North America; rare ..... *C. harwoodi*

6. Not over 12 papillae in each lateral row 7
Twelve papillae or more in each lateral row 8

7. Esophageal length less than 1/2 diameter of oral sucker; 8–12 papillae in lateral rows, rows extend beyond ends of midventral ridge; uterus with 12–14 loops, 3–4 previtelline; vitellaria start at or behind middle of body (Fig. 44.6); Eurasia, Africa; very common ..... *C. verrucosa*
Esophageal length more than 1/2 diameter of oral sucker; 7–8 papillae in each lateral row, along ventral ridge; uterus with 20 transverse loops, 5–6 previtelline (Fig. 44.7); Asia; rare ..... *C. orientalis*

8. Lateral rows with 12–18 papillae; uterus with 24–26 transverse loops, 9 previtelline; vitellaria start posterior to middle of body (at 60/100) (Fig. 44.8); Japan; rare ..... *C. cygni*
Lateral rows with 15–17 papillae; uterus with 20 transverse loops, about 4 previtelline; vitellaria start anterior to middle of body (at 43/100) (Fig. 44.9); Eurasia; rare ..... *C. hisikui*

Descriptions: Lutz 1928; Yamaguti 1939; Skrjabin 1953; Singh 1956.

Genus *Notocotylus*

Family Notocotylidae

Note: Metacercariae encysted on surface of snail, vegetation, or other solid object in fresh water (13 species), or sea water (two species). Synonymy: *N. anatis*, *N. duboisi*, and *N. lucknowensis* synonyms of *N. imbricatus*; *N. asperiductus* and *N. chenis nomina nuda*; *N. intestinalis* and *N. triserialis* synonyms of *N. attenuatus*; *N. indicus* and *N. solitaria* synonyms of *N. babai*; *N. chionis* of authors and *N. orientalis* synonyms of *N. parviovatus*; *N. anseri* and *N. kanpurensis* probably synonyms of *N. parviovatus*; *N. thienemanni* synonym of *N. ephemera*. *N. nathipandei* not in waterfowl, but included in key.

1. Single row of ventral "glands" (papillae) 2
Three rows of ventral papillae 3

2. Body ovate, broad, 1.4–2.5 mm long; one row of five ventral papillae; cirrus sac reaches to 1/3 of body length, 440–800μ long; uterus with 8–13 transverse loops, 3–5 anterior to vitellaria (previtelline) (Fig. 45.1); England, Australia; frequent in Australia; in bursa of Fabricius, cloaca ..... *N. gippyensis*
Body elongate, sides parallel, 1.5–1.9 mm long; one median row of seven papillae; cirrus sac reaches to 1/4 length of body, 310–530μ long; uterus with 12–17 transverse loops, 4–5 previtelline (Fig. 45.2); Australia; frequent ..... *N. tadornae*

3. Median row of ventral papillae number 4–8; body oval 4
Median row of ventral papillae number 10–26; body usually elongate 7

4. Papillae in middle row number half as many as in lateral rows, 4–5 and 10–12; cirrus sac extends little more than 1/3 length of body; vitelline glands start at about middle of body (Fig. 45.3);

North America, South America, Eurasia; rare, normally in coots and gallinules. . . . . *N. pacifera*
Three rows of papillae with nearly the same number 5

5. Ventral rows with 6–10 papillae per row; cirrus sac reaches 37–44/100 of body length; vitellaria start at middle of body (Fig. 45.4); Central America, Eurasia; infrequent, normally in coots . . . . . *N. gibbus*
Ventral rows with 4–5 papillae per row; in bursa of Fabricius of host. 6

6. Genital pore posterior to cecal fork; ventral rows of papillae with five papillae each, nearly same size; cirrus sac reaches 1/4 length of body; vitellaria start at 35–39/100 of body length (Fig. 45.5); Asia; rare . . . . . *N. skrjabini*
Genital pore anteriad almost to oral sucker; median ventral papillae much larger than lateral papillae, five papillae in median row, four in each lateral row; cirrus sac reaches 1/4 of body length; vitellaria start at 39/100 of body length (Fig. 45.6); North America; in duck from experimental infection, natural host unknown . . . . . *N. breviserialis*

7. Median row of ventral papillae with over 18 papillae 8
Ventral papillae number 10 to 18 in median row. 9

8. Median row with 18–24 papillae, 19–26 in lateral rows; median row starts 1/2 papilla interval before or after lateral rows; cirrus sac reaches 32–42/100 of body length; metraterm 2/5–2/3 length of cirrus sac; uterine loops number 17–26, 7–10 previtelline (Fig. 45.7); Eurasia; common, in geese and swans. . . . . *N. parviovatus*
Median row with 23–26 papillae, 24–29 in lateral rows; uterus with 27–34 loops, 11–17 previtelline; median row of papillae starts 1/2 interval anterior to lateral rows; cirrus sac reaches 30/100 of body; metraterm 3/5 of cirrus sac length; body 3–6.5 mm long (Fig. 45.8); Europe; in duck from experimental infection, normally in rails . . . . . *N. ralli*

9. Cirrus sac 2,500–2,800μ long, reaching posteriad to middle of body (51/100); 15–16 papillae in median row (Fig. 45.9); Argentina; rare, in steamer duck . . . . . *N. tachyeretis*
Cirrus sac less than 1,300μ long, not reaching beyond middle of body. 10

10. Genital pore anterior to cecal fork 11
Genital pore posterior to or at level of cecal fork 13

11. Median row of papillae starts 1/2 interval before lateral rows; 11–13 papillae in median row, 11–12 in lateral rows; metraterm as long as cirrus sac; three to four previtelline uterine loops; body 1.9–2.9 mm long; Eurasia; rare . . . . . *N. mamii*
Median row of papillae starts 2 1/2 papillae intervals before lateral rows 12

12. Median row with 13 papillae, 10 in lateral rows; metraterm 4/5 length of cirrus sac; cirrus sac extends to 37/100 of body length; oral sucker 85–110μ diameter (Fig. 45.10); Philippine Islands; rare, in domestic duck . . . . . *N. naviformis*
All rows with 12–14 papillae; metraterm about 1/2 length of cirrus sac; cirrus sac extends to 26/100 of body length; oral sucker 200μ diameter; Europe, Africa; infrequent or rare, in domestic duck. . . . . *N. aegyptiacus*

13. Metraterm 1/3 length of cirrus sac; first median papilla 2.5 intervals before first lateral papillae; body 1–1.27 mm long; testes up to 170μ long; oral sucker 70μ diameter (Fig. 45.11); Eurasia; rare, normally in shorebirds. . . . . *N. linearis*
All measurements generally greater—metraterm longer, oral sucker over 100μ diameter; median row of papillae starts 0.5 to 2.5 intervals anteriad of lateral rows 14

14. Lateral rows with 9–10 papillae, first median papilla 0.5–2.5 intervals before first lateral papillae; body 1.1–2.5 mm long (Fig. 45.12); Eurasia; infrequent . . . . . *N. ephemera*
Lateral rows with 12–19 papillae. 15

15. Median row with 10–12 papillae, lateral rows with 12–14. 16
Median row with 13–18 papillae, lateral rows with 14–19. 17

16. Median row with 12 ventral papillae, 12–14 in each lateral row; cirrus sac extends to 37–47/100 of body length; metraterm 5–6/10 length of cirrus sac; vitellaria start at 47–60/100 of body length; North America, Europe; infrequent ..... *N. seineti*
Median row with 10–11 ventral papillae, 12–14 in each lateral row; cirrus sac extends to 28–38/100 of body length; metraterm 57–93/100 of cirrus sac length; vitellaria start at 36–46/100 of body length (Fig. 45.13); Asia; rare ..... *N. duboisianus*

17. More than half of uterine loops (10–11 of 17–18) anterior to vitellaria; vitellaria start at 60–64/100 of body length; body 2–3.8 mm long (Fig. 45.14); Asia; rare ..... *N. babai*
Less than half of uterine loops anterior to vitellaria; vitellaria start mostly anterior to midline of body length 18

18. Metraterm over half length of cirrus sac (50–83/100)—(*attenuatus* group, separation difficult, descriptions unreliable; intermediate hosts important) 19
Metraterm 1/2 or less of cirrus sac length 20

19. Uterus with 20 transverse loops, 2–5 previtelline; first papilla of median row 0.5–1.5 intervals anterior to lateral rows; 14–19 papillae in lateral rows, 13–18 in median row; cirrus sac 600–1,300μ long; testes with five lobes; variety of snails reported as intermediate hosts—some probably erroneously; body 1.5–5 mm long (Fig. 45.15); North America, Eurasia, Australia; characteristic ..... *N. attenuatus*
Uterus with 18–20 transverse loops, 3–5 previtelline; first papilla of median row 1–1.5 intervals before lateral rows; 14–17 papillae in lateral rows, 13–15 in median row; cirrus sac about 1,000μ long; testes with 2–4(8?) lobes (Fig. 45.16); intermediate host lymnaeid snails; North America; in duck from experimental infection, once in shorebird ..... *N. stagnicolae*
Uterus with 20 transverse loops, 9–13 (about half) previtelline; median papillae start 1/2 interval before lateral rows; 15–19 papillae in lateral rows, 13–18 in median row; cirrus sac 946μ long; testes with 8–12 lobes (Fig. 45.17); intermediate hosts physid snails; North America; rare, probably normally in muskrats and voles ..... *N. urbanensis*

20. Cirrus sac extent less than 41/100 of body length from anterior 21
Cirrus sac extends more than 41/100 of body length 25

21. Lateral rows with 18 papillae, 14 in middle row; first median papilla 1.5 intervals behind lateral rows; cirrus sac reaches 29/100 of body length from anterior; metraterm 2/5 length of cirrus sac (Fig. 45.18); in chicken; India; rare ..... *N. nathipandei*
Lateral rows with 14–18 papillae; first median papilla 1/2 interval anterior or posterior to lateral rows 22

22. Single polar filament on egg at one pole, eggs 23μ by 13μ; vitellaria start at 33/100 of body length; 16–18 papillae in lateral rows, 15 in median row; cirrus sac reaches 1/3 length of body; uterus with 19–21 transverse loops, 4–7 previtelline (Fig. 45.19); Asia; experimental infection in ducks, natural host unknown ..... *N. zduni*
Filament at each pole of egg; vitellaria start at about midline (42–60/100); cirrus sac extends from less to more than 1/3 body length; lateral rows with 14–16 papillae 23

23. Median and lateral rows with 16 papillae, cirrus sac extends to over 1/3 of body length (37/100); uterus with 14–24 loops, 2–8 previtelline; metraterm less than 1/2 cirrus sac length; vitellaria start at 45–52/100 of body length (Fig. 45.20); intermediate host brackish water snail; North America; in duck as experimental host, natural host unknown ..... *N. atlanticus*
Median row with 14 papillae; uterus with 8–10 previtelline loops 24

24. Cirrus sac extends less than 1/3 length of body (32/100); uterus with 18–19 transverse loops, 8–9 previtelline; metraterm 1/2 cirrus sac length; testes irregularly margined; eggs 24–27μ long; vitellaria start at 48–54/100 of body length (Fig. 45.21); North America, Asia; infrequent, in geese ..... *N. imbricatus magniovatus*

Cirrus sac reaches more than 1/3 body length (32–41/100); uterus with about 25 transverse loops, 10 previtelline; metraterm 1/4–1/2 length of cirrus sac; vitellaria start at 52–60/100 of body length; testes deeply incised into lobes; eggs 18–22μ long (Fig. 45.22); North America, Eurasia; infrequent ..... *N. i. imbricatus*

25. Body oblong, 1–1.5 mm long; first median papilla 1/2 interval anterior to lateral rows; 15–16 papillae in median row, 16 in lateral rows; cirrus sac reaches about midline, 450–560μ long; uterus with 12–16 transverse loops, about 3–4 previtelline; vitellaria start posterior to midline (Fig. 45.23); North America; rare ..... *N. minutus*

Body elongate, 3–3.3 mm long; first median papilla 1.5–2.5 intervals before lateral rows; 14–15 papillae in median row, 14–16 in lateral rows; cirrus sac reaches 42/100 of body length, 1,170–1,290μ long; uterus with 20 loops, 6–8 previtelline; vitellaria start at 51/100 of body length (Fig. 45.24); North America, Asia; infrequent ..... *N. dafilae*

Descriptions: Skrjabin 1953; Beverley-Burton 1958; Stunkard 1960*a*, 1966, 1967; Odening 1964; Chiaberashvili and Dzhavelidze 1968; Gupta and Gupta 1976, 1977; Bisset 1977.

Genus *Paramonostomum*

Family Notocotylidae

Note: At least some infections (five species) obtained by ingestion of brackish-water snails. Synonymy: *P. brantae* synonym of *P. alveatum; P. obtortum* synonym of *Notocotylus pacifera. P. anatis*, in domestic duck, USSR, indistinguishable from *P. pseudalveatum*, may be synonym.

Description of *P. bychowskoi-pawlowskoi* not available, species is omitted; described from tufted duck and gray heron; Azerbaidzhan SSR.

1. Body oval, not more than twice as long as wide, usually shorter; mostly in intestine of host 2

Body elongate, more than twice as long as wide; most commonly in ceca of host 5

2. Genital pore posterior to cecal fork; with about 12 transverse uterine loops, one previtelline; body minute, 0.25–0.5 mm long (Fig. 46.1); North America, Europe; infrequent ..... *P. parvum*

Genital pore at or anterior to cecal fork; fewer than 12 transverse uterine loops 3

3. Body 1.03–1.68 mm long, just twice as long as wide; genital pore anterior to cecal fork; about 10–12 transverse uterine loops; metraterm shorter than cirrus sac (Fig. 46.2); Asia; experimental infection in domestic duck, natural host unknown ..... *P. philippinensis*

Body less than 1 mm long 4

4. Ovary partly caudad to testes; 6–11 transverse uterine loops, sometimes one or two previtelline; posterior end of cirrus sac about 1/3 from anterior end of body; metraterm 2/3 length of cirrus sac; body 0.5–0.9 mm long (Fig. 46.3); North America, Eurasia; frequent ..... *P. alveatum*

Posterior edge of ovary level with testes; 5–6 transverse uterine loops, none previtelline; posterior end of cirrus sac 28/100 of body length from anterior end; metraterm 1/2 length of cirrus sac; body 0.39–0.5 mm long (Fig. 46.4); North America, Europe; infrequent ..... *P. pseudalveatum*

Eight transverse uterine loops; body 0.42–0.46 mm long; USSR; rare, in domestic duck ..... *P. anatis*

5. Genital pore before cecal fork 6

Genital pore at or posterior to cecal fork 10

6. Cirrus sac extending more than 1/3 of body length; vitellaria start posterior to middle of body 7

Cirrus sac not extending beyond first 1/3 of body; vitellaria start before middle of body 8

7. Cirrus sac extending to 38/100 of body length, 498–581μ long; uterus with 12–14 transverse loops, about six anterior to vitellaria; anterior end of vitellaria at 54/100 of body length; eggs 16.2μ long; body 1.7–1.9 mm long (Fig. 46.5); Asia; rare ..... *P. nettioni*

Cirrus sac extending to middle of body, 1,900–2,190μ long; uterus with 12–15 transverse loops, about 1 previtelline; anterior vitellaria at 52/100 of body length; eggs 26–28μ long; body 4.1–4.3 mm long (Fig. 46.6); North America; rare ..... *P. malerischi*

8. Genital pore at rear edge of oral sucker; ceca slender; testes extremely lobate, branched; uterus with 16 transverse loops, 4–5 previtelline; eggs 15μ long; body 3.8 mm long (Fig. 46.7); India; rare ..... *P. casarcum*
Genital pore just anterior to cecal fork; small diverticula on ceca; testes less lobate 9

9. Esophagus longer than diameter of oral sucker; uterus with 18–20 transverse loops, 3–4 previtelline; metraterm as long as cirrus sac; cirrus sac 533–683μ long; eggs 18μ long; body 2–2.3 mm long (Fig. 46.8); India; rare ..... *P. harwoodi*
Esophagus about equal to diameter of oral sucker; uterus with 17–18 transverse loops, 6 previtelline; cirrus sac 930μ long; eggs 20μ long; body 3.4 mm long (Fig. 46.9); India; rare ..... *P. querquedulum*

10. First vitellaria anterior to middle of body; esophagus less than length of oral sucker; eggs 15μ by 9μ; body 2.7–4 mm long; China; rare ..... *P. ovatus*
First vitelline gland posterior to middle of body; eggs larger, 19–25μ long 11

11. Cirrus sac extends to 2/5 length of body from anterior end; metraterm 1/2 length of cirrus sac; 17 transverse loops, 7 previtelline; eggs 19–25μ by 10–15μ; body 0.5–0.8 mm long; (Fig. 46.10); Europe; rare ..... *P. chabaudi*
Cirrus sac extends to 45–47/100 of body length; metraterm 1/2–2/5 of cirrus sac length; 9–11 transverse uterine loops, 4–5 previtelline; eggs 22.4μ long; body 0.8–1.1 mm long (Fig. 46.11); USSR; rare ..... *P. alveoelongatum*
Cirrus sac extends to middle of body or farther 12

12. Esophagus shorter than diameter of oral sucker; small diverticula on ceca; uterus with 16–18 transverse loops, 5–7 previtelline; vitellaria posterior, start at 60–70/100 of body length from anterior end; body 1.4–1.9 mm long (Fig. 46.12); North America; rare ..... *P. histrionici*
Esophagus about same or longer than oral sucker; no diverticula on ceca; uterus with fewer loops 13

13. Esophagus about equal to diameter of oral sucker; 15–16 transverse loops in uterus, 3 previtelline; vitellaria start at 55/100 from anterior end; eggs 18–22μ by 10–13μ; body 1.5–4.5 mm long (Fig. 46.13); Eurasia; infrequent ..... *P. bucephalae*
Esophagus about equal or longer than diameter of oral sucker; uterus with 14 transverse loops, 5 previtelline; vitellaria start at 61/100 from anterior end; eggs 22–23μ by 12–13μ; body 2.3–6.9 mm long (Fig. 46.14); Korea; rare ..... *P. elongatum*

Descriptions: Hsü 1935; Skrjabin 1953; Dunagan 1957; Baugh 1958; Ching 1961*b*; Nath and Pande 1962; Garkavi 1965; van Strydonck 1965; Velasquez 1969*a*; Filimonova 1971.

Genus *Tristriata*

Family Notocotylidae

Note: Source of infection unknown, almost surely snails or debris.

1. Body oval, twice as long as wide, 1.5–2.7 mm long; transverse uterine loops number 17, 11 previtelline; cirrus sac reaches to 37/100 of body length (Fig. 47.1); North America; Asia; infrequent ..... *T. anatis*
Body elongate, 4.5–5 times longer than wide, 2.7–4 mm long; transverse uterine loops number 20–24, 10–12 previtelline; cirrus sac reaches 42–49/100 of body length (Fig. 47.2); USSR; rare ..... *T. elegans*

Descriptions: Frame 1969; Filimonova 1971.

Genus *Renicola*

Family Renicolidae

Note: Source of infections unknown, probably marine fish.

1. Testes generally lobed, or irregularly shaped 2
   Testes entire, round or oval 5

2. Vitellaria in two rows of follicles 3
   Vitellaria in two compact clusters of few (about 8–9) large follicles; caudal end of body very prolonged, pointed (Fig. 48.1); Europe; rare, normally in lariform birds . . . . . *R. lari*

3. Vitelline follicles small, numerous (30–45), crowded in lateral columns in middle 1/3 of body; body club-shaped, 2–2.37 mm long (Fig. 48.2); Asia; rare, originally described from grebe . . . . . *R. umigarazu*
   Vitelline follicles few (five to six on each side), large, contiguous in two short rows; body club-shaped, 1.15–2.1 mm long (Fig. 48.3); Asia; rare, perhaps normally in lariform birds, first described from cormorant . . . . . *R. keimahuri*
   Vitelline follicles large, in extended rows, not contiguous 4

4. Two rows of vitelline follicles, from anterior margin to base of caudal process, inward from lateral margins; body round, with caudal process, 0.83–1.45 mm long (Fig. 48.4); Asia; infrequent . . . . . *R. mediovitellata*
   Two rows of vitelline follicles, from level of oral sucker to level of testes, 115–171μ in from lateral margin, 560–590μ extent; body ovate with caudal process, 1.32–3.2 mm long; testes round in younger worms (Fig. 48.5); Europe; infrequent . . . . . *R. mollissima*

5. Ovary trilobed; testes oval, contiguous; body club-shaped, 1.16–2.15 mm long; vitellaria rather medial, extend from oral area to base of caudal process; North America; rare . . . . . *R. brantae*
   Ovary slightly lobed; testes round; body club-shaped to round, with caudal process, 0.87–1.42 mm long; vitelline follicles small, closely packed, rather medial, in two bands from pharynx to base of caudal process (Fig. 48.6); Eurasia; infrequent . . . . . *R. somateriae*

Descriptions: Skrjabin 1947; Bykhovskaya-Pavlovskaya 1950; McIntosh and Farr 1952; Belopol'skaya 1952*b*; Kulachkova 1957.

Genus *Eucotyle*

Family Eucotylidae

Note: Source of infections unknown. Synonymy: *E. clangulae* synonym of *E. cohni*. All species but *E. hassalli* parasitic in Anatidae.

1. Vitellaria extending posteriad well below testes, past midline 2
   Vitellaria not extending posteriad of testes, or only slightly so 7

2. Testes ovate or pear-shaped, smooth-margined; ovary oval; esophagus inflated at anterior; eggs 25μ long by 13μ (Fig. 49.1); Eurasia; infrequent . . . . . *E. popowi*
   Testes lobed or with irregular margin 3

3. Brown pigmented granules throughout parenchyma; eggs 30–41μ long; body 6.25–7.2 mm long (Fig. 49.2); North America; rare . . . . . *E. castanea*
   No brown pigmented granules in parenchyma 4

4. Testes ovate, length:width 1.25:1; eggs large, 43μ long by 16μ; esophagus inflated at anterior; body 5.6 mm long (Fig. 49.3); North America, Eurasia; infrequent . . . . . *E. cohni*
   Testes elongate, length:width 3(or more):1; eggs smaller 5

5. Esophagus not inflated at anterior end; eggs 27μ long by 14μ; body 3.5 mm long (Fig. 49.4); Eurasia; rare ..... *E. nephritica*
   Esophagus inflated at anterior end 6

6. Testes lobed at ends; ovary lobed; eggs 22μ long by 11μ (Fig. 49.5); North America; in grebes, rare ..... *E. hassalli*
   Testes with irregular margins only; ovary lobed; eggs 29–33μ long by 15–17μ (Fig. 49.6); Brazil; rare, in domestic duck ..... *E. freitasi*

7. Testes pear-shaped, smooth, touching at midline; ovary oval; eggs 35μ long by 17μ (Fig. 49.7); North America, Eurasia; frequent ..... *E. zakharowi*
   Testes lobed, not touching; ovary lobed 8

8. Esophagus inflated at anterior; body small, 2.4 mm long; eggs 30–33μ long (Fig. 49.8); North America, Europe; infrequent ..... *E. wehri*
   Esophagus cylindrical, not inflated 9

9. Eggs 28–35μ long by 12–14μ; body 4–4.8 mm long; testes narrow, well separated; esophagus 343–405μ long; body spines sharp-pointed, 11–14μ long (Fig. 49.9); North America; rare ..... *E. warreni*
   Eggs 27–33μ long by 15–18μ; body 2.3–4 mm long; testes rosette-shaped, almost touching; esophagus 248μ long (Fig. 49.10); China; rare ..... *E. baiyangdienensis*

Descriptions: Skrjabin 1947; Schell 1967; Jensen 1971; Costa and Freitas 1972; Lee et al. 1973.

Species *Tanaisia fedtschenkoi*

Family Eucotylidae

Note: Source of infection unknown. These variations are not distinctly established as subspecies; the forms in North and South America have not been identified further than to species.

1. Cuticle with pectinate scales, scales 6.2–10.9μ wide, with 4–9 (mostly 5–8) teeth per scale (Fig. 50.1); Asia; rare ..... *T. f. meridionalis*
   Pectinate scales on cuticle 10.4–17μ wide, with 5–10 (double teeth if the lower number) teeth per scale (Fig. 50.2); Europe; rare?, typically in Charadriiformes ..... *T. f. fedtschenkoi*

Descriptions: Odening 1964.

Genus *Prosthogonimus*

Family Haplometridae

Note: Infections obtained by ingestion of Odonata (dragonfly) nymphs or adults. Synonymy: Only three species definitely recognized. *P. anatinus, P. gracilis, P. horiuchii, P. japonicus, P. karausiaki, P. leei, P. orientalis, P. pellucidus, P. penni, P. putschkowskii, P. querquedulae, P. rudolphii, P. sinensis, P. skrjabini,* and very possibly *P. spinatus* and *P. ventroporus*, synonyms of *P. cuneatus; P. limani* and *P. ryjikowi* synonyms of *P. ovatus; P. sudarikovi* synonym of *P. macrorchis.* Classification discussed in Krasnolobova 1970.

1. Small lobe protruding to left of oral sucker and extending more anteriad than tip of longitudinal axis, containing genital pores; testes nearly round, smooth; vitellaria in two dense lateral clusters anterior to level of rear margin of testes; uterine loops fill area posterior to testes; ovary posterior to acetabulum (Fig. 51.1); Vietnam; rare, in domestic duck ..... *P. ventroporus*
   Longitudinal axis the most anteriorly projecting lobe, genital pores to side and usually slightly posterior to fore edge of oral sucker 2

2. Uterus with loops in area anteriad and posteriad of acetabulum; ovary at level of acetabulum or more anterior, lobed (Fig. 51.2); cosmopolitan; very common ..... *P. ovatus*

Uterine loops present only posteriad of acetabulum; ovary posterior to acetabulum, or only slightly overlapping its edge, lobed 3

3. Vitellaria not extending posteriad of level of rear edge of testes, in several diffuse clusters; testes more or less oval, smooth (Fig. 51.3); North America, Asia; frequent ..... *P. macrorchis*
Vitellaria in lateral clusters extending posteriad past level of rear edge of testes 4

4. Anterior of body covered with large spines, up to 31–35μ long; Ukraine; rare, in domestic duck ..... *P. spinatus*
Spines on body smaller (20–23μ long) (Fig. 51.4); cosmopolitan; very common ..... *P. cuneatus*

Descriptions: Skrjabin 1962; Shevtsov 1966; Oshmarin 1970.

Genus *Levinseniella*

Family Microphallidae

Note: Infections obtained by ingestion of aquatic crustacea (two species known from fresh water, two from sea water). Synonymy: *L. belopolskoi* synonym of *L. pellucidus; L. charadriformis* synonym of *Ascorhytis charadriformis; L. minutus* transferred to *Atriophallophorus minutus; L. somateriae* transferred to *Microphallus somateriae.*
Several species designated *species inquirendae* by Deblock and Pearson 1971.

1. Acetabulum may be enclosed within genital sinus; genital papilla spiny at tip; opening to genital cavity and acetabulum a narrow slit; seminal vesicle bent at angle before prostatic area; one male pocket of genital sinus sclerotized to special spindle-like structure, others not described; vitellaria in two masses of few large follicles (Fig. 52.1); Vietnam; rare, in domestic duck ..... *L. cryptacetabula*
Acetabulum in normal condition, exposed at surface 2

2. Voluminous female pouch present in annex of genital atrium on acetabular side, very tortuous internally 3
No female pouch present, or presence not reported 5

3. Male copulatory organ (digitiform pocket) with two groups of processes, each with four short and one long; prepharynx longer than pharynx; esophagus about twice length of prepharynx (112–160μ long) (Fig. 52.2); Asia; rare (*species inquirenda*) ..... *L. camtshatica*
Three or four pockets in male copulatory organ 4

4. Three or four pockets in male copulatory organ, each with three teeth or hooks; prepharynx slightly longer than pharynx; esophagus (about 130μ long) twice as long as pharynx; testes smooth, oval (Fig. 52.3); North America, Eurasia; infrequent ..... *L. propinqua*
Three pockets in male copulatory organ, with ribs but no teeth or hooks; prepharynx and esophagus about same length (85μ and 70μ long, respectively), both longer than pharynx; testes slightly irregular in form, oval (Fig. 52.4); North America, Eurasia; infrequent .... *L. brachysoma*

5. Esophagus short (63–120μ long), about twice length of pharynx; prepharynx shorter than pharynx; ovary lobed, to right of acetabulum; vitellaria in two irregular masses; genital complex not described; testes transversely oval; eggs 21–35μ long (Fig. 52.5); Brazil; rare (*species inquirenda*) ..... *L. cruzi*
Esophagus long, much more than twice length of pharynx; prepharynx shorter or longer than pharynx 6

6. Male copulatory organ with three pockets; pharynx very small (25–28μ long); prepharynx as long as pharynx; ceca rather short, reach level of fore margin of acetabulum; eggs 16–19μ long (Fig. 52.6); Eurasia, North Africa; infrequent ..... *L. pellucida*
Male copulatory organ with four pockets; pharynx larger 7

7. Ceca very short (132–185μ long), reaching well short of level of acetabulum; prepharynx shorter than pharynx (Fig. 52.7); North America; in duck from experimental infection, natural host unknown (*species inquirenda*) ..... *L. amnicolae*
Ceca longer, reach level of rear margin of acetabulum; prepharynx longer than pharynx 8

8. Body 0.67–1.17 mm long; oral sucker 60–78μ by 78–96μ; acetabulum 57–75μ diameter; esophagus 210–350μ long; eggs 18–21μ long (Fig. 52.8); Asia; infrequent (*species inquirenda*) ..... *L. bucephalae*
Body larger, 1.4–1.05 mm long; oral sucker 95–96μ by 112μ; acetabulum 120μ by 85μ; esophagus 416–560μ long; eggs 23–26μ long (Fig. 52.9); Asia; rare (*L. bucephalae* of Ryzhikov and Timofeeva 1961) ..... *Levinseniella* sp.

Descriptions: Belopol'skaya 1952*a*, 1963; Ryzhikov and Timofeeva 1961; Oshmarin 1970; Deblock and Pearson 1971.

Genus *Maritrema*

Family Microphallidae

Note: Infections obtained by ingestion of aquatic crustacea, two species in fresh water and five in sea water. Synonymy: *M. raminellae* transferred to *Odhneria; M. nettae* synonym of *M. obstipum; M. rhodanicum* synonym of *M. subdolum*.

1. Vitelline follicles in cluster of six to eight on each side, not posterior to testes; body elongate; esophagus long, 170–280μ long; cirrus sac arched, anterior to acetabulum; metraterm muscular, strongly curved, 144μ long; uterus post-testicular, extends along margins to vitellaria (Fig. 53.1); North America, Asia; infrequent ..... *M. japonicum*
Vitelline follicles in ring or horseshoe shape 2

2. Cirrus sac with very thick muscular walls 3
Cirrus sac with thin walls (may be muscular) 6

3. No spiny structure in genital sinus or cirrus sac; oral sucker and acetabulum about equal size; ceca widely divergent, short, not reaching posteriad of cirrus sac 4
Genital sinus with spines 5

4. Esophagus 35μ long, longer than prepharynx; cirrus sac about 1/2 body length; testes nearly round or slightly transversely oval; eggs numerous (over 60), 12μ long (Fig. 53.2); South America; rare ..... *M. nicolli*
Esophagus and prepharynx equal length; eggs number 4–10 in uterus, 18–23μ long; cirrus sac reaches almost across body, distal end tapering, hooked; testes oval (Fig. 53.3); Australia; rare ..... *M. calvertensis*

5. Comb of fine spines on genital sinus; ceca short, widely divergent, do not extend posteriad of cirrus sac; acetabulum slightly larger than oral sucker; esophagus very short (5μ); vitellaria in horseshoe shape (Fig. 53.4); Asia; rare ..... *M. inusitata*
Genital sinus with many spines on surface; acetabulum about 1.7 times size of oral sucker; esophagus 33–94μ long; cirrus sac walls thick, sclerotized, striated; ceca reach level of fore margin of acetabulum; vitellaria in horseshoe shape, interrupted at anterior (Fig. 53.5); Asia; rare, in domestic duck ..... *M. mapaensis*

6. Oral sucker and acetabulum nearly equal in size 7
Acetabulum larger than oral sucker (about 1.3–1.5 times larger) 10

7. Ovary to right of acetabulum 8
Ovary median in location 9

8. Acetabulum with short spines anteriad; esophagus short, 13–44μ long; prepharynx short; ceca widely divergent, reach level of fore margin of acetabulum; uterus may fill body (Fig. 53.6); North America; rare, in domestic duck ..... *M. obstipum*
Ovary slightly to right of acetabulum or median; no spines on acetabulum; esophagus long, 58–148μ long; prepharynx long; ceca diverge at acute angle, extend past level of acetabulum; uterus within ring of vitellaria (Fig. 53.7); North America; rare (see also below, in No. 9) ..... *M. paracadiae*

9. Ovary triangular, slightly lobed; seminal vesicle large, oval, in rear half of cirrus sac; suckers 42–62μ diameter; uterus within vitellarian ring (Fig. 53.8); North America, Eurasia, Africa; rare ..... *M. gratiosum*
Ovary globular; seminal vesicle slightly S-shaped in elongate sac; uterus extends past vitellarian ring anteriorly; suckers small, 26–39μ diameter (Fig. 53.9); North America; rare ..... *M. acadiae*
Ovary oblong, rarely median; seminal vesicle elongate, fills 1/3–1/2 cirrus sac; suckers 32–52μ diameter; uterus within vitellarian ring (Fig. 53.7); North America; rare ..... *M. paracadiae*

10. Ovary median in location **11**
Ovary to right of acetabulum **12**

11. Body ovoid to linguiform; prepharynx 0–40μ long; esophagus 38–76μ long; cirrus sac arched over acetabulum, 120–200μ long; seminal vesicle large, with loop into convoluted ejaculatory duct; ovary often lobed (Fig. 53.10); Europe; rare ..... *M. macracetabulum*
Body oval; prepharynx equals length of pharynx (30–33μ); esophagus about 60–90μ long; cirrus sac arching around acetabulum, seminal vesicle rather small, ejaculatory duct in loops, very long; ovary elongate, submedian (Fig. 53.11); Eurasia; frequent ..... *M. subdolum*

12. Body elongate to compact, 0.35–0.47 mm long; prepharynx 0–40μ long, esophagus 45–90μ long; ceca divergent, reach level of rear of acetabulum; cirrus large, fleshy, smooth; cirrus sac arched over acetabulum, 100–115μ long, about 1/4 body length; seminal vesicle very sinuous; testes transversely oval; ovary transversely ovoid; vitellaria in horseshoe or rarely a ring; uterus posterior to acetabulum, metraterm large, muscular (Fig. 53.12); North America; rare ..... *M. megametrios*
Body oval, 0.7–1.0 mm long; esophagus moderate or long; ceca divergent, reach level of rear edge of acetabulum; vitelline ring complete or incomplete; cirrus sac 1/5–1/6 of body length; testes oval; ovary round; uterus within vitelline ring with loops projecting; metraterm obscure, passes through glandular mass (Fig. 53.13); North America, Asia; rare, normally in mammals? ..... *M. a. afanassjewi*
Body oval, 0.4 mm long; prepharynx shorter than pharynx; esophagus short, about 35μ long; ceca reach fore margin of acetabulum; ovary oval or round; testes round; uterus extends beyond vitelline ring (Fig. 53.14); Asia; rare, in domestic duck ..... *M. afanassjewi minor*

Descriptions: Belopol'skaya 1952*a*, 1963; Leonov and Tsimbalyuk 1963; Deblock and Rosé 1965; Deblock and Rausch 1968; Ching 1974; Smith 1974.

Genus *Microphallus*

Family Microphallidae

Note: Infections obtained by ingestion of marine crustacea or snails. Synonymy: *M. afanassjewi nomen nudum; M. excellens* synonym of *M. similis; M. fusiformis* synonym of *Gymnophallus rostratus; M. longicollis* synonym of *M. claviformis; M. oidemia* synonym of *M. pygmaeus.*

M. hoffmani omitted, no description available; Europe; in duck from experimental infection, natural host shorebirds.

1. Oral sucker larger than acetabulum **2**
Oral sucker smaller than acetabulum **8**
Oral sucker and acetabulum essentially equal size **10**

2. Vitellaria in compact mass, follicles scarcely discernible 3
Vitelline follicles separate, distinct 6

3. Ovary at same level as acetabulum 4
Ovary primarily anterior to acetabulum 5

4. Oral sucker 27–50μ, acetabulum 26–32μ; body 0.2–0.5 mm long; pharynx small; genital papilla 18–21μ diameter; vitelline group lobulate; ceca reach level of rear of acetabulum (Fig. 54.1); North America, Eurasia; common ..... *M. pygmaeus*
Oral sucker 55–85μ diameter; acetabulum 48–70μ; body 0.5–1.8 mm long; pharynx small, 20–52μ by 23–34μ; ceca reach middle of acetabulum (Fig. 54.2); Australia; rare ..... *M. tasmaniae*

5. Pharynx much smaller than oral sucker (1/4–1/5); ovary away from acetabulum; ceca do not reach level of acetabulum; testes posterior to acetabulum (Fig. 54.3); North America, Eurasia; infrequent ..... *M. claviformis*
Pharynx 1/2–1/3 diameter of oral sucker; ovary partly overlapping acetabulum; ceca reach level of rear area of acetabulum; testes at level of rear half of acetabulum (Fig. 54.4); in Arctic North America, Asia; rare, perhaps normally in carnivorous mammals ..... *M. pirum*

6. Testes at level of rear portion of acetabulum and ovary; ovary and testes ovate; male papilla without pseudogonotyl; seminal vesicle sacculate, not V-shaped; body spatulate, anterior part very long, narrow; ceca reach rear margin of acetabulum; cecal fork more than esophageal length anterior to acetabulum (Fig. 54.5); China; rare, in domestic duck ..... *M. longicaecus*
Testes posterior to acetabulum and ovary 7

7. Male papilla large (larger than acetabulum), with ventral muscular flap or pseudogonotyl, 40–56μ by 13–26μ; genital sac very large, seminal vesicle V-shaped; vitellaria in two loose groups, about 8–10 follicles each (Fig. 54.6); China; rare, in domestic duck ..... *M. pseudogonotylus*
Male papilla smaller, 31–34μ by 26–31μ, no pseudogonotyl; seminal vesicle oval, much larger than male papilla; vitellaria in two contiguous groups of eight follicles each (Fig. 54.7); USSR; rare ..... *M. tauricus*

8. Esophagus of moderate length, 50–80μ; ceca short, widely divergent, reach level of seminal vesicle; male papilla very large, 80–90μ by 40–50μ, much larger than seminal vesicle or acetabulum; vitelline follicles large, in two groups posterior to testes (Fig. 54.8); North America, Europe; infrequent, normally in Charadriiformes ..... *M. papillorobustus*
Esophagus long, 100–300μ; ceca extend to area of acetabulum or more posteriad; male papilla much smaller, smaller or larger than seminal vesicle 9

9. Vitellaria enclose testes; male papilla muscular, bottle-shaped, smaller than seminal vesicle; metraterm muscular; ceca reach level of middle of acetabulum (Fig. 54.9); North America, Eurasia; infrequent, probably normally in Charadriiformes ..... *M. primas*
Vitelline follicles in two rosettes to rear of testes; male papilla muscular, conical or pear-shaped, larger than seminal vesicle; ceca extend to testes posteriad of acetabulum; testes oval or irregular (Fig. 54.10); North America, Europe; rare, normally in Charadriiformes ..... *M. similis*

10. Vitellaria two diffuse masses of very small follicles; body pear-shaped, 0.51–0.58 mm long; esophagus very long; ceca widely divergent, reach level of acetabulum (Fig. 54.11); North America, Europe; rare ..... *M. nicolli*
Vitelline follicles separate, distinct 11

11. Esophagus short or moderate, 32–37μ long; testes at level of rear of acetabulum; body very small, pear-shaped, 0.13–0.16 mm long; male papilla very small and short, 7μ diameter (Fig. 54.12); Europe; infrequent ..... *M. somateriae*
Esophagus very long, 103μ; testes just posterior to acetabulum, suboval; vitellaria in two groups of about five follicles just posterior to testes; male papilla 53μ by 45μ, without lobes; body pyriform, 0.541 mm long (Fig. 54.13); North America; infrequent ..... *M. oblonga*

Descriptions: Belopol'skaya 1952*a*, 1963; Chen 1956; Ching 1965*b*; Sten'ko 1973; Smith 1974.

Genus *Odhneria*

Family Microphallidae

Note: Source of infection unknown; probably freshwater crustacea.

1. Suckers large, oral sucker 85–90μ diameter, acetabulum 90μ by 100μ; cirrus sac 140–150μ long; ovary adjacent to right testis; body 0.8 mm long (Fig. 55.1); North America, South America; rare ..... *O. odhneri*
   Suckers smaller, oral sucker 70μ diameter; acetabulum 65–80μ diameter; cirrus sac 100–130μ long; ovary well separated from right testis; body 0.75–1 mm long (Fig. 55.2); North America; rare ..... *O. raminellae*

Descriptions: Dery 1958; Sinclair 1971; Deblock 1972.

Genus *Plagiorchis*

Family Plagiorchidae

Note: Infections obtained by ingestion of freshwater invertebrates—insects, snails, crustacea. Synonymy: *P. brauni*, *P. casarcii*, *P. cirratus*, *P. ferruginum*, *P. laricola*, *P. potanini*, and *P. uhlwormi* all synonyms of *P. elegans; P. obtusus* synonym of *P. fastuosus; P. maculosus anatis* and *P. russii* synonyms of *P. maculosus*.

1. Body oval or ellipsoid, broad (width 40–60% of length) 2
   Body elongate, often tapering at one or both ends, or oblong (width less than 40% of length) 3

2. Acetabulum generally 2–3 times size of pharynx; oral sucker and acetabulum nearly same size; two lateral bands of vitellaria generally joining posteriad; testes round or oval (Fig. 56.1); North America, Eurasia, Australia; rare, typically in passeriform birds ..... *P. maculosus*
   Acetabulum and pharynx nearly same size; oral sucker about 1.5 times larger than acetabulum; two lateral bands of vitellaria joining anteriad and posteriad, start from area of oral sucker; testes round (Fig. 56.2); Asia; rare ..... *P. nyrocae*

3. Acetabulum 0.9–2 times size of pharynx; body elongate, tapering posteriad, to oblong; oral sucker 1.2–1.7 times larger than acetabulum; testes somewhat oval; lateral vitellarian fields generally joining posteriad, at both ends, or not at all, start at area of cecal fork (Fig. 56.3); North America, Eurasia; frequent ..... *P. elegans*
   Acetabulum and pharynx about equal size; oral sucker about 1.5–2 times size of acetabulum; lateral vitellarian fields joining posteriad, start posteriad of cecal fork; testes round (Fig. 56.4); Eurasia; rare ..... *P. nanus*
   Acetabulum generally 2–3 times size of pharynx 4

4. Oral sucker and acetabulum nearly same size ..... *P. maculosus*, see above
   Oral sucker about twice size of acetabulum; acetabulum 1.3–2 times larger than pharynx; testes oval or slightly irregular; lateral vitellarian fields join at both ends (Fig. 56.5); Eurasia; rare ..... *P. fastuosus*

Descriptions: Skrjabin and Antipin 1959; Ryzhikov and Timofeeva 1962; Styczynska-Jurewicz 1962.

Genus *Apophallus*

Family Heterophyidae

Note: Infections obtained by ingestion of freshwater fish. *A. imperator* erroneously reported in waterfowl.

1. Body ovate or pear-shaped, to 1.3 mm long; acetabulum about 1/3 length of body from anterior end; testes round, smooth, oblique; vitellaria start at level of cecal fork; uterus with 34 eggs

(in original figure) (Fig. 57.1); North America, Europe; rare, normally in fish-eating birds and mammals ..... *A. donicum*

Body elongate, 0.6 mm long, anterior portion narrowed; acetabulum near middle of body; testes irregular-margined, tandem; vitellaria start at level of ovary; uterus with 1–8 eggs (Fig. 57.2); Europe, North Africa; experimental infection in duck, natural host unknown..... *A. bacalloti*

Descriptions: Morozov 1952.

Genus *Ascocotyle*

Family Heterophyidae

Note: Infections of *A. angrensis* obtained by ingestion of fresh- or brackish-water fish.

1. One circle of oral spines (Fig. 58.1); Eurasia, Africa; probably accidental in domestic duck, normally in fish-eating mammals..... *A. italica*

   One circle of 16–18 oral spines plus 2–3 dorsal accessory spines (Fig. 58.2); North America, South America; accidental in waterfowl, normally in herons and fish-eating mammals ..... *A. angrense*

Descriptions: Morozov 1952

Genus *Cryptocotyle*

Family Heterophyidae

Note: Infections obtained by ingestion of marine fish and sometimes also (*C. concavum*) from freshwater fish.

1. Body ovate; testes opposite; ceca bending sharply mediad at posterior end of body 2

   Body elongate, oblong, or linguiform; testes oblique; ceca not bending sharply mediad at posterior 3

2. Testes slightly lobed, transversely elongate; vitellaria in lateral bands uniting before genital sinus and at posterior end; eggs elliptical (Fig. 59.1); North America, Eurasia; frequent, normally in fish-eating birds ..... *C. concavum*

   Testes lobed, deeply incised, transversely elongate; vitellaria in two lateral bands remaining distinct; eggs crescent- or kidney-shaped (Fig. 59.2); Europe; rare, normally in fish-eating birds ..... *C. cryptocotyloides*

3. Testes weakly lobed, triangular; esophagus rather long, three times length of pharynx; vitellarian fields join anteriad of genital sinus (Fig. 59.3); Europe; rare, normally in fish-eating birds ..... *C. jejuna*

   Testes slightly lobed; esophagus short, barely longer than pharynx; vitellarian fields join anterior to genital sinus and at posterior end (Fig. 59.4); North America, Eurasia; infrequent, normally in fish-eating birds and mammals..... *C. lingua*

Descriptions: Morozov 1952.

Genus *Haplorchis*

Family Heterophyidae

Note: Infections obtained by ingestion of fresh- and brackish-water fish.

1. Apical part of acetabulum with 12–16 spines, 25–30μ long, and small medial patch of spines; ceca extend nearly to posterior end (Fig. 60.1); Asia, Africa; in duck from experimental infection, normally in fish-eating birds and mammals ..... *H. taichui*

   Apical part of acetabulum with crown of 32–40 bars, 2.5–5.9μ long, and patches of spines on two lateral lobes; ceca barely reach level of anterior edge of testis (Fig. 60.2); Eurasia, Africa, Oceania; in duck from experimental infection, normally in fish-eating birds and mammals ..... *H. pumilio*

Descriptions: Morozov 1952.

Genus *Procerovum*

Family Heterophyidae

Note: Infections obtained by ingestion of fresh- and brackish-water fish. Synonymy: *P. sisoni* synonym of *P. varium*.

1. Seminal vesicle tripartite (two thin-walled portions, thick-walled posterior expulsor), latter less than 100μ long; ceca extend to level of middle of testis; vitelline follicles primarily lateral (Fig. 61.1); China; in duck from experimental infection, natural host unknown ..... *P. cheni*
   Seminal vesicle bipartite (thin-walled proximal portion and distal sausage-shaped expulsor) 2

2. Expulsor less than 100μ long; ceca widely divergent, do not extend posteriad of level of anterior of testis; vitelline follicles in two posterolateral lines (Fig. 61.2); China; rare, natural host unknown ..... *Procerovum* sp.
   Expulsor between 100μ and 250μ long 3

3. Expulsor 96–140μ long; ceca reach level of anterior edge of testis; vitelline follicles in horseshoe arrangement, lateral bands connected by cross-bar dorsal and anterior to testis (Fig. 61.3); Asia, Australia; rare, in duck from experimental infection, natural host unknown ..... *P. varium*
   Expulsor 185–250μ long; ceca extend posteriad of testis; vitelline follicles in posterior of body (Fig. 61.4); Philippine Islands; rare, normal host not known ..... *P. calderoni*

Descriptions: Pearson 1964; Velasquez 1973.

Genus *Stictodora*

Family Heterophyidae

Note: Infections of *S. sawakinensis* obtained by ingestion of marine fish.

1. Vitellaria lateral, start anterior to testes; no cirrus sac, seminal vesicle bipartite; eggs small, 27–30μ by 15–17μ (Fig. 62.1); Eurasia, Africa; rare, normally in gulls and terns ..... *S. sawakinensis*
   Vitellaria posterior to testes; seminal vesicle tripartite; eggs larger, 30–36μ by 15–22μ 2

2. Vitellaria scattered behind testes, intercecal; acetabulum a solid body 60–80μ wide, with two spiny pads (Fig. 62.2); Asia; rare, infrequent in gulls ..... *S. japonica*
   Vitellaria lateral, behind testes; acetabulum a solid body 45–70μ diameter, tip with many spines projecting into genital atrium; seminal vesicle with three to four parts (Fig. 62.3); Japan; rare ..... *S. mergi*

Descriptions: Morozov 1952.

Genus *Amphimerus*

Family Opisthorchiidae

Note: Infections of *A. elongatus* obtained by ingestion of freshwater fish. Synonymy: *A. filiformis* synonym of *A. anatis*; *A. bogoriensis* a provisional species, not included.

1. Muscular oral sucker present; body slender, tapering at each end, 23 mm long; testes elliptical, 600μ by 350μ (Fig. 63.1); Eurasia; common ..... *A. anatis*
   Oral sucker absent; body rather broad and rounded at posterior end, tapering toward anterior 2

2. Body 20–23 mm long, maximum width 1.09–1.12 mm; testes long-oval, lobate, 1,500μ by 300μ; acetabulum 1/3 body length from anterior end; pharynx 64μ by 32–41μ (Fig. 63.2); North America; infrequent ..... *A. elongatus*

Body 15 mm long, 0.8 mm wide at posterior end; testes variable, sometimes lobed; acetabulum about 1,200μ from anterior end; pharynx 45μ by 30μ (Fig. 63.3); North America, Asia; infrequent ..... *A. lintoni*

Descriptions: Skrjabin and Petrov 1950.

Genus *Metorchis*

Family Opisthorchiidae

Note: Infections obtained by ingestion of freshwater fish. Synonymy: *M. albidus* and *M. crassiusculus* synonyms of *M. bilis*; *M. coeruleus*, *M. intermedius*, and *M. pinguinicola* synonyms of *M. xanthosomus*.

1. Testes round or oval, not lobed 2
   Testes lobed, or irregular in shape 4

2. Length of esophagus about 1/2 diameter of oral sucker; distance from cecal fork to acetabulum 4–5 times diameter of acetabulum; testes oblique; acetabulum larger than oral sucker; body 1.4–1.54 mm long (probably not fully developed), pear-shaped (Fig. 64.1); Europe; rare ..... *M. zacharovi*
   Length of esophagus equals diameter of oral sucker; distance from cecal fork to acetabulum equals diameter of acetabulum; acetabulum and oral sucker about same size; testes tandem 3

3. Testes round; acetabulum at 1/3 of body length from anterior end; esophagus slightly longer than pharynx; cuticle spiny; body elongate, 4.3–5.6 mm long (Fig. 64.2); Asia; infrequent, in domestic duck ..... *M. taiwanensis*
   Testes ovoid; acetabulum at about 2/5 of body length from anterior; no esophagus; body elongate, 1.55 mm long (Fig. 64.3); Europe; rare ..... *M. hovorkai*

4. Pharynx about as large as acetabulum; body elongate, 3.2–4.5 mm long; acetabulum about 1/3 body length from anterior end; vitellaria extending anteriad nearly to pharynx (Fig. 64.4); Asia; rare ..... *M. elegans*
   Pharynx much smaller than acetabulum 5

5. Body pear-shaped, spatulate, or ovate, about 1/2–1/3 as wide as long 6
   Body elongate, width about 1/3 to 1/6 of length 7

6. Body 2.4 mm long by 1.062 mm maximum width; acetabulum slightly larger than oral sucker; eggs 26–28μ long; esophagus about as long as pharynx (Fig. 64.5); Asia; rare ..... *M. nettioni*
   Body 1.6–4.3 mm long, 0.8–1.5 mm wide; acetabulum slightly smaller than oral sucker; eggs 25–32μ long; esophagus about 1/2 length of pharynx (Fig. 64.6); North America, Eurasia, Africa; infrequent ..... *M. bilis*

7. Acetabulum at about middle of body, slightly smaller than oral sucker; body 2 mm long; eggs 26μ long (Fig. 64.7); Europe; rare ..... *M. tener*
   Acetabulum at about 1/4–1/3 of body length from anterior end 8

8. Acetabulum about equal to oral sucker in size, located about 1/3 of body length from anterior; eggs 25–29μ long (Fig. 64.8); Eurasia; common ..... *M. xanthosomus*
   Acetabulum slightly smaller than oral sucker, located about 1/4 of body length from anterior; eggs 29–32μ long (Fig. 64.9); Asia; frequent ..... *M. orientalis*

Descriptions: Skrjabin and Petrov 1950; Macko 1955; Baugh 1958; Odening 1962*a*; Belogurov and Leonov 1963.

Genus *Opisthorchis*

Family Opisthorchiidae

Note: Source of infections unknown, probably freshwater fish. Synonymy: *O. desouzai nomen nudum; O. sankunnyi*

nomen nudum; O. poturzycensis synonym of *O. simulans; O. tenuicollis* of Wu 1937 unidentified; *O. pianae* synonym of *Hypoderaeum conoideum; O. tsingkiangpuensis* synonym of *Amphimerus anatis; Notaulus asiaticus* synonym of *O. longissimus. O. choledocus* probably not valid, not reported since 1883.

1. Vitellaria start anterior to acetabulum, do not reach level of ovary; ovary oval; oral sucker and acetabulum about same size (Fig. 65.1); Asia; rare, in domestic duck ..... *O. skrjabini*
   Vitellaria start at acetabulum or more posteriad, extend to level of ovary or farther; ovary lobed or irregular 2

2. Vitellaria start at level of acetabulum, at about 1/3 or 1/4 body length from anterior; acetabulum larger than oral sucker; testes much branched 3
   Vitellaria start at about middle of body, well behind acetabulum; acetabulum much smaller than oral sucker 4

3. Vitellaria extend posteriad to testes; acetabulum barely larger than oral sucker (235μ and 225μ diameters); testes with rounded lobes; body 5.9–8.25 mm long; eggs 26–29μ long (Fig. 65.2); North Vietnam; rare, in domestic duck ..... *O. parageminus*
   Vitellaria extend posteriad as far as ovary; acetabulum larger than oral sucker (380μ and 340μ diameters); testes lobed; eggs small, 26μ long; body 9 mm long; Turkestan; rare, not reported since 1883 ..... *O. choledocha*
   Vitellaria extend posteriad to first testis; acetabulum slightly larger than oral sucker (acetabulum 260μ, oral sucker 150–240μ diameter); testes much branched or lobed; body 2.5–5.1 mm long; eggs 25–30μ long (Fig. 65.3); Asia, Australia; infrequent ..... *O. obsequens*

4. Acetabulum much smaller than oral sucker (200μ and 500μ diameters); body 7–23 mm long, very slender (Fig. 65.4); Eurasia, Africa; common ..... *O. simulans*
   Acetabulum slightly smaller than oral sucker 5

5. Testes close together at posterior end; body 20–24 mm long, 0.7–1 mm wide, very slender (Fig. 65.5); Eurasia; infrequent, normally in herons and perhaps in predatory birds ..... *O. longissimus*
   Testes well separated, more than own diameter apart, in posterior 1/5 of body; body 7–12.5 mm long, 1.3–2 mm wide (Fig. 65.6); Eurasia, Africa; infrequent ..... *O. geminus*

Descriptions: Skrjabin and Petrov 1950; Oshmarin 1970.

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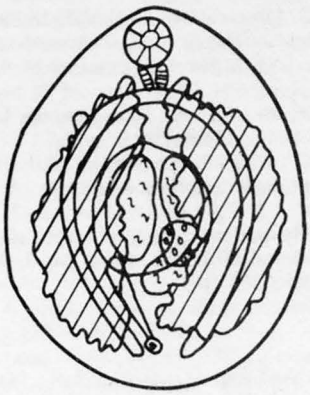
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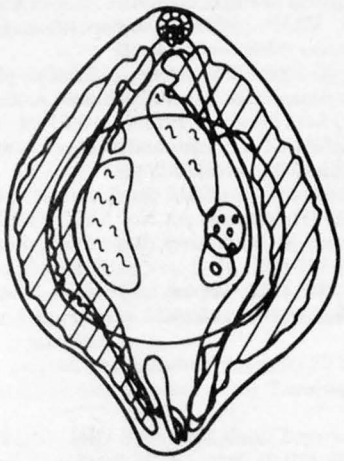
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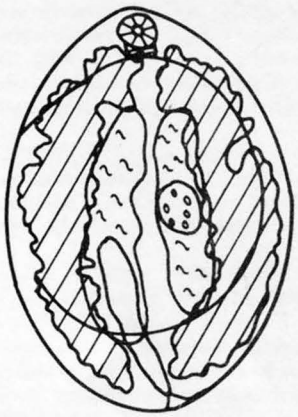
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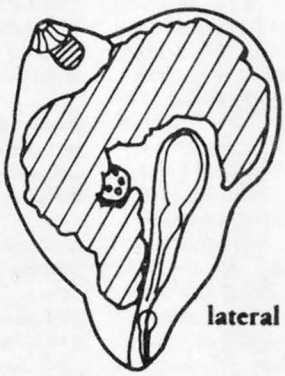
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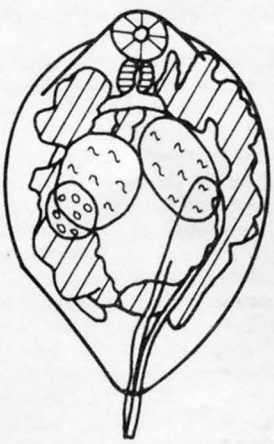
2.3 *C. indica*



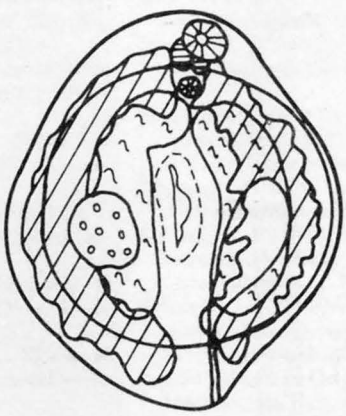
2.4 *C. opaca*



2.5 *C. melanittae*



2.6 *C. prussica*



2.7 *C. skrjabini*

Fig. 2. Genus *Cyathocotyle*

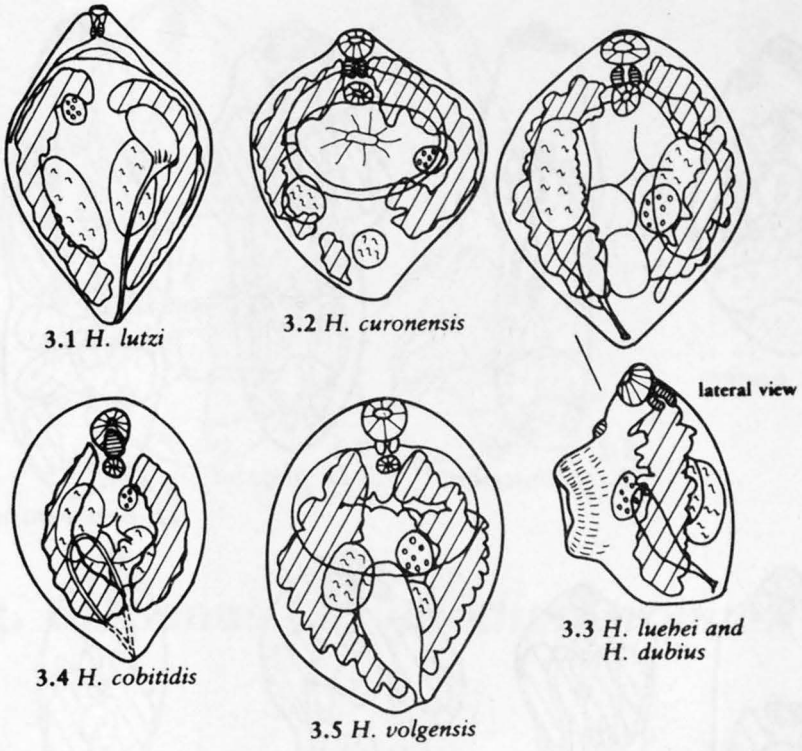


Fig. 3. Genus *Holostephanus*

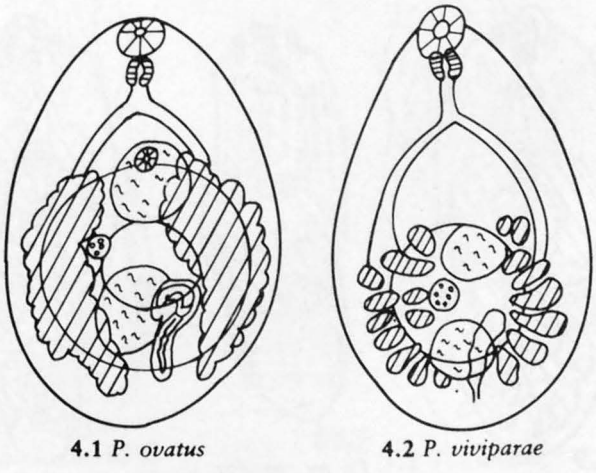


Fig. 4. Genus *Paracoenogonimus*

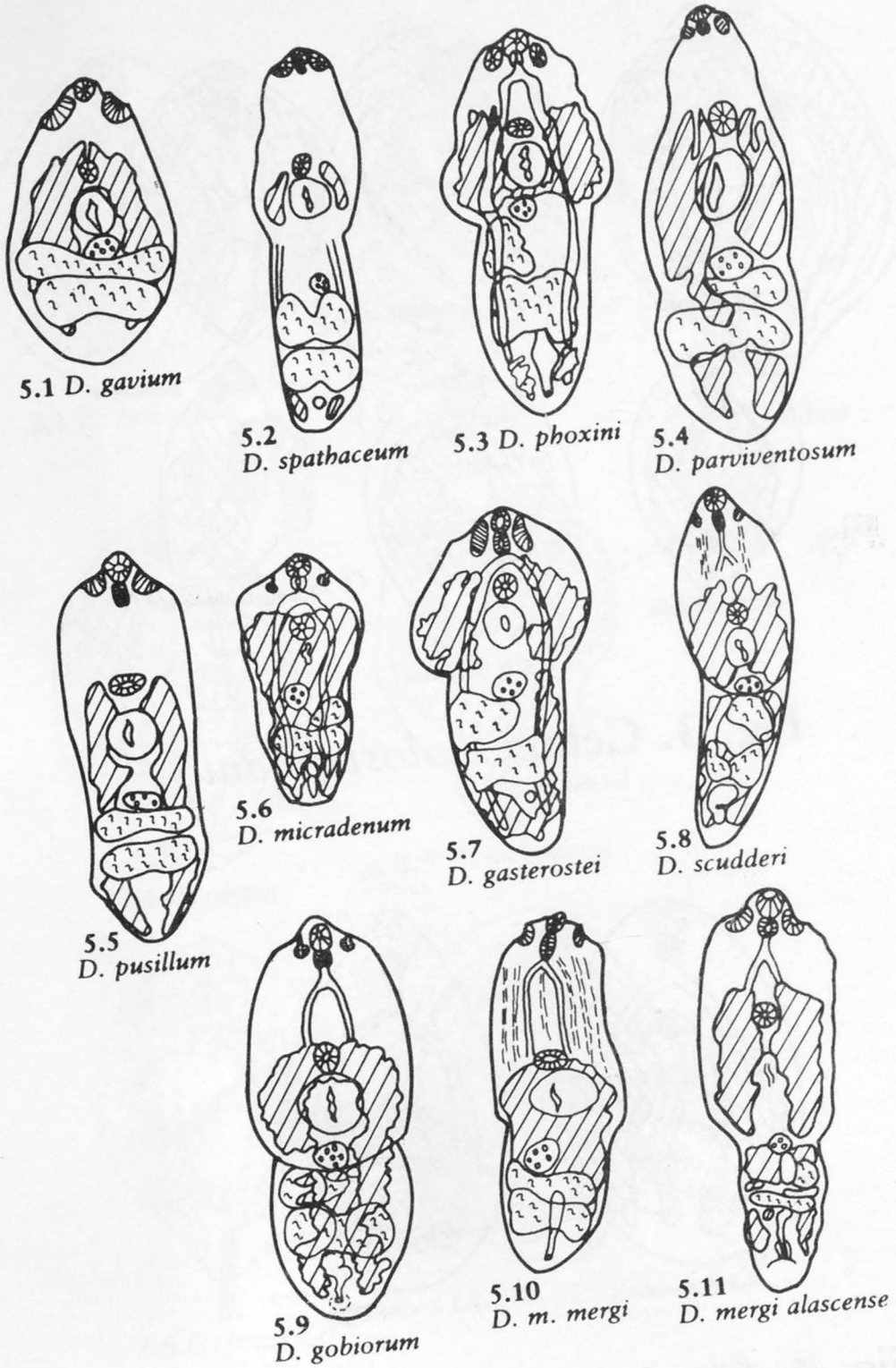


Fig. 5. Genus *Diplostomum*

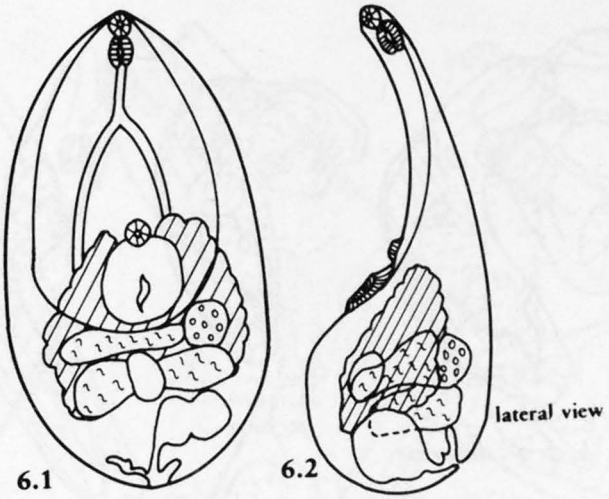


Fig. 6. Genus *Ornithodiplostomum*

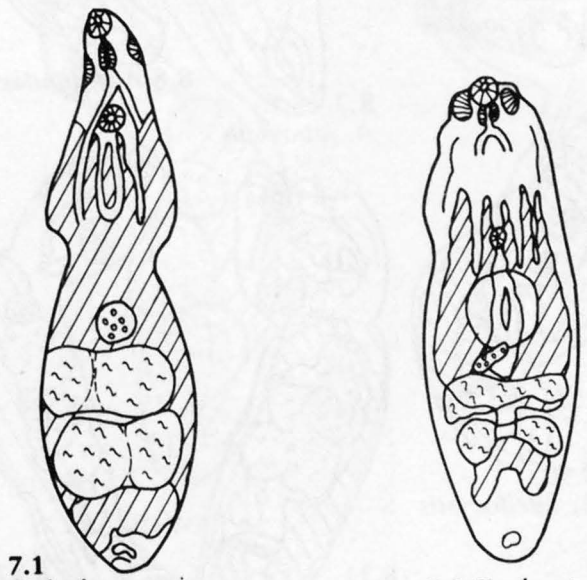


Fig. 7. Genus *Tylodelphys*

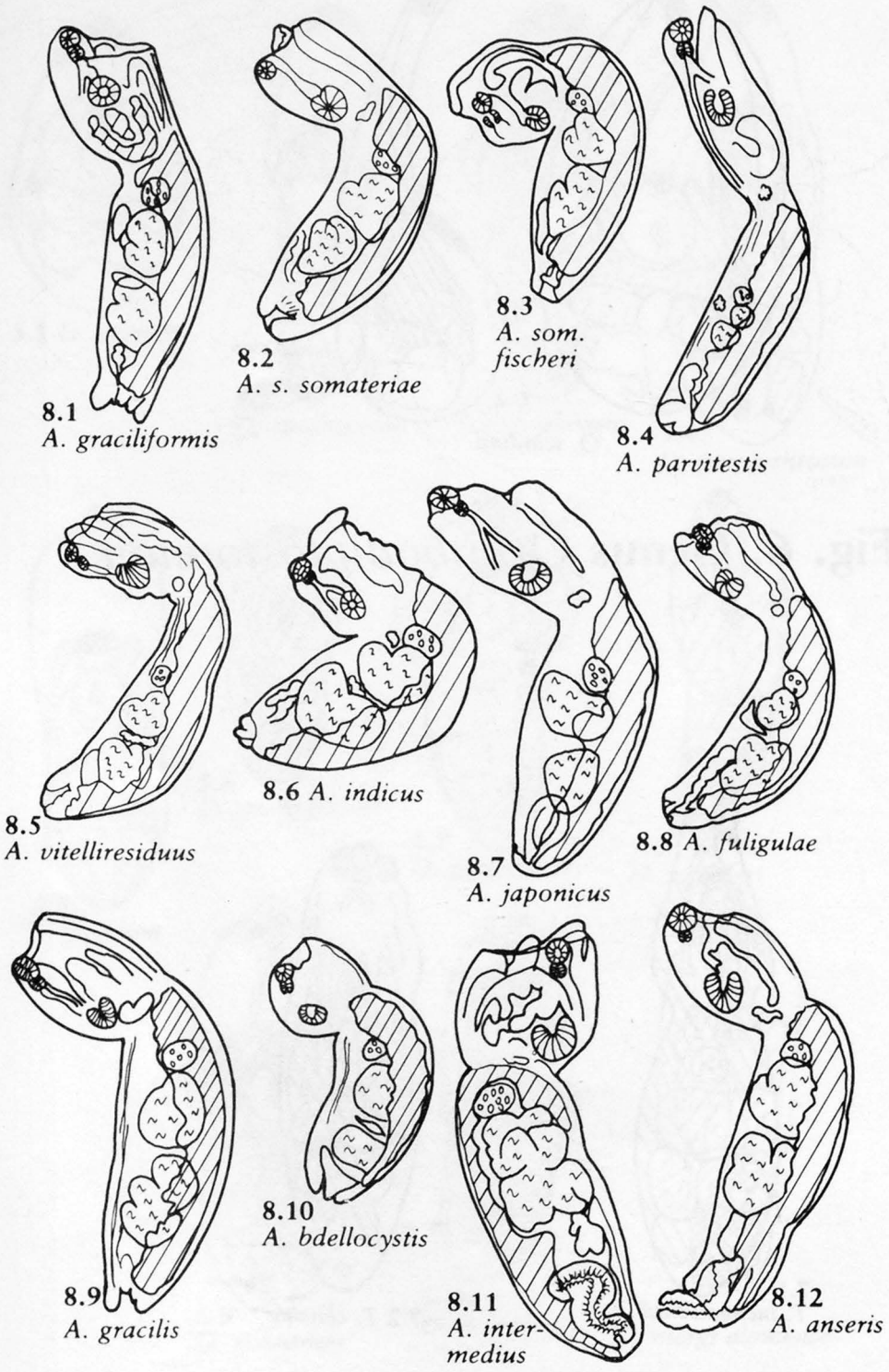


Fig. 8. Genus *Apatemon*

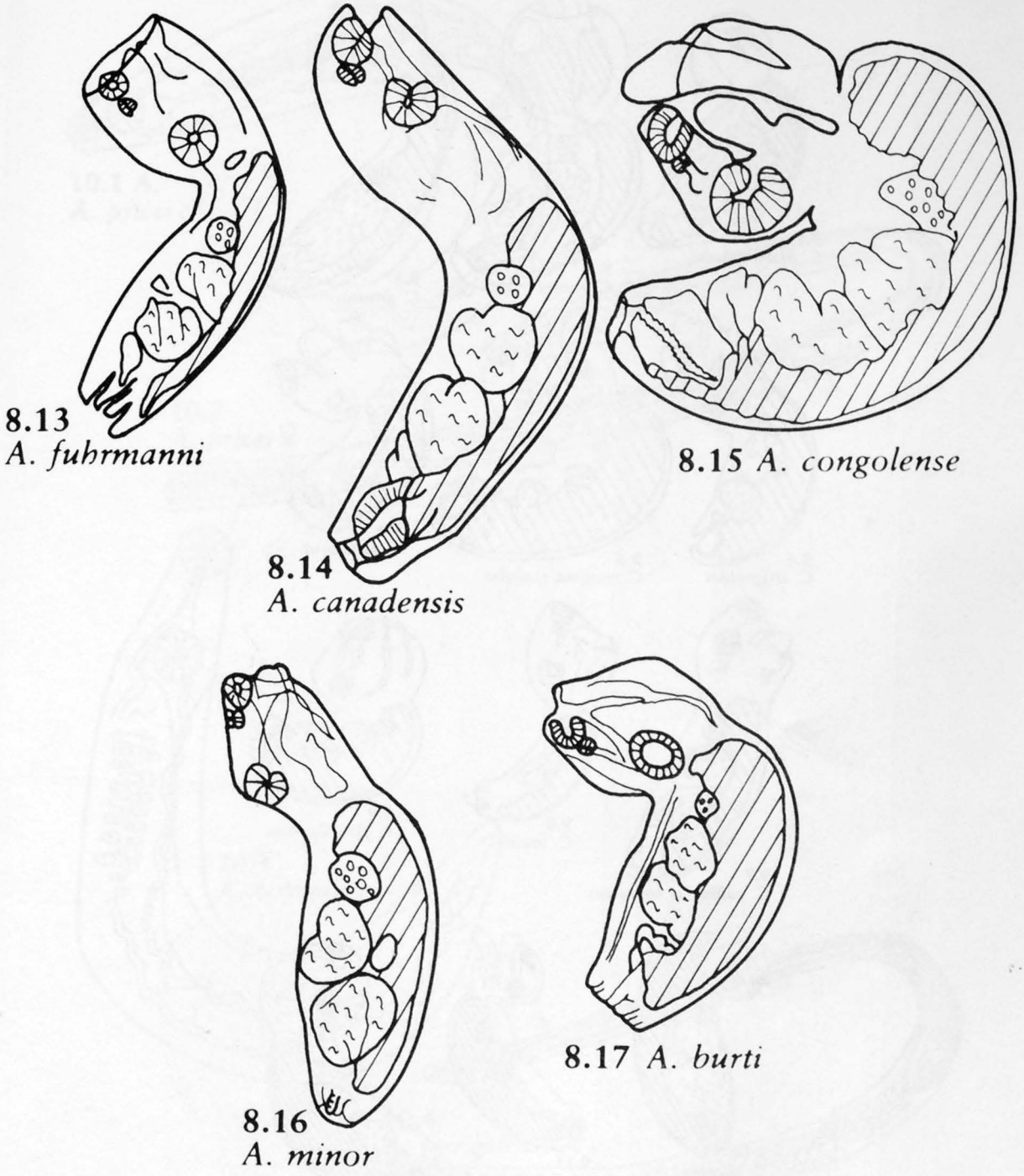


Fig. 8. Genus *Apatemon* (cont. - 2)

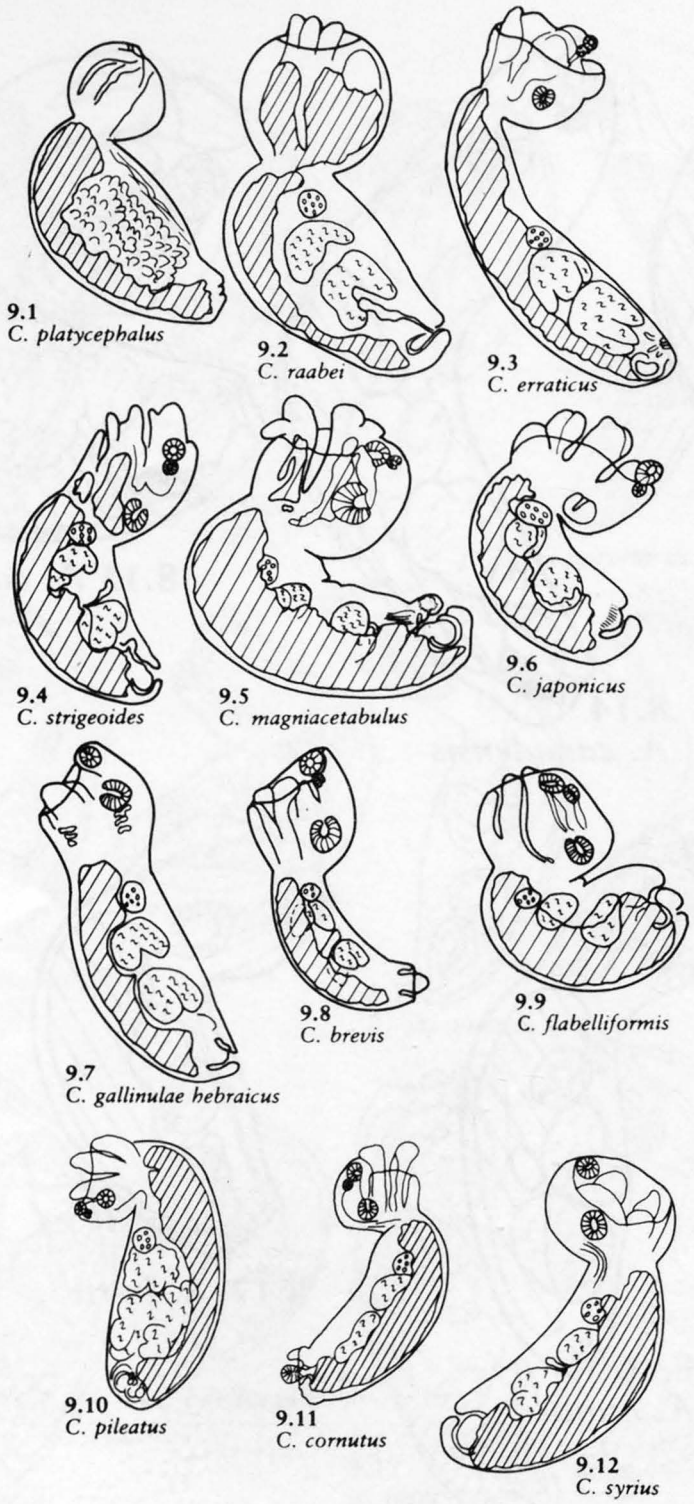


Fig. 9. Genus *Cotylurus*

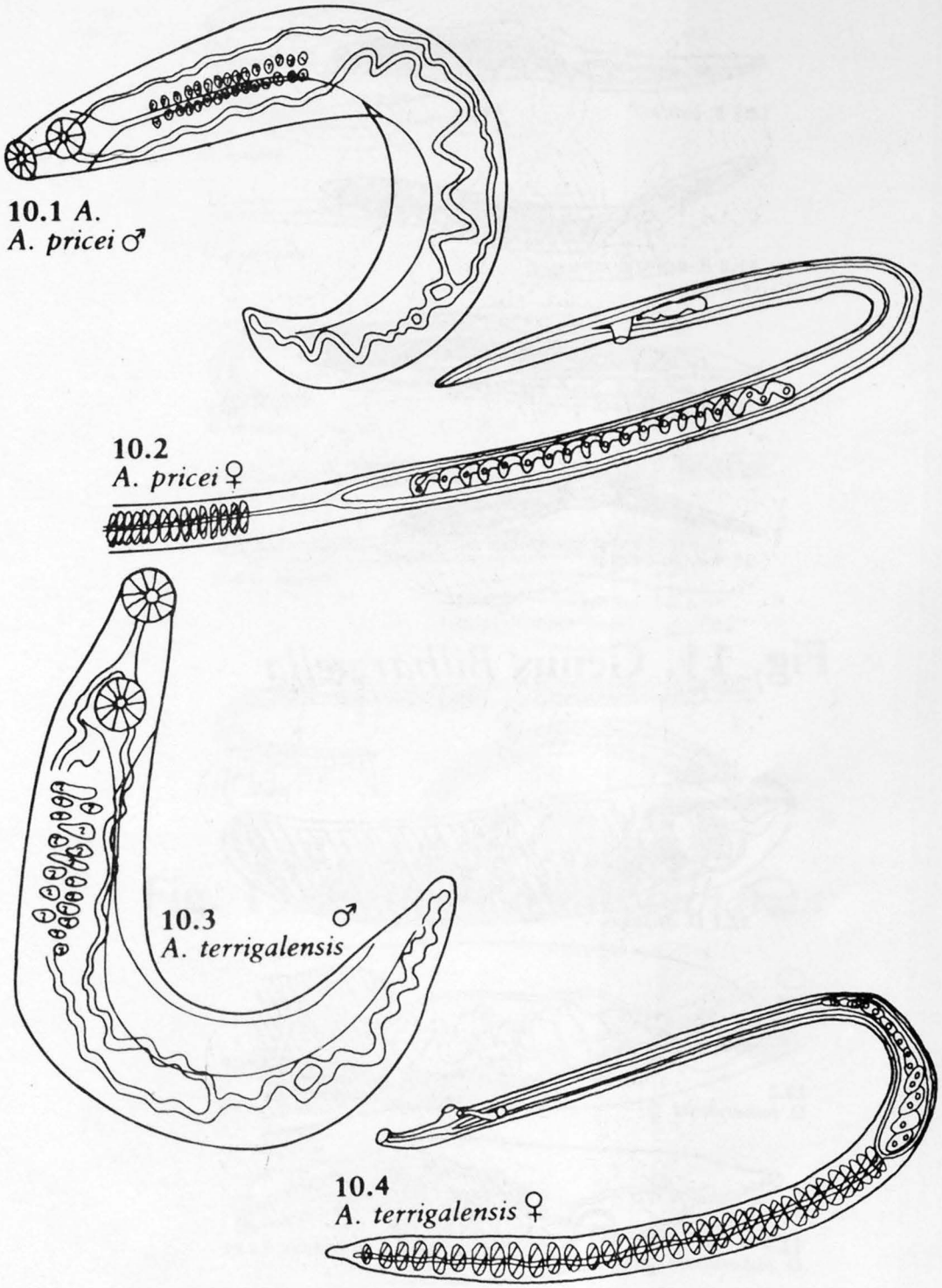
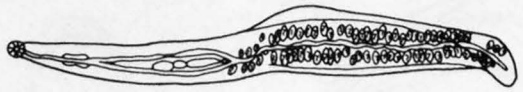
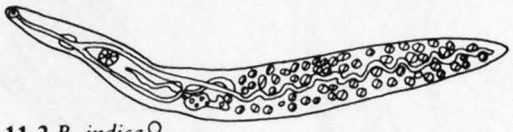


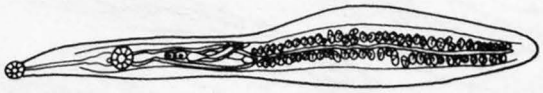
Fig. 10. Genus *Austrobilharzia*



11.1 *B. indica* ♂



11.2 *B. indica* ♀

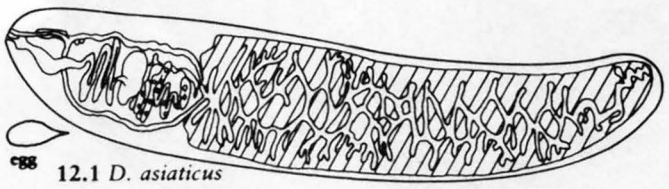


11.3 *B. polonica* ♂

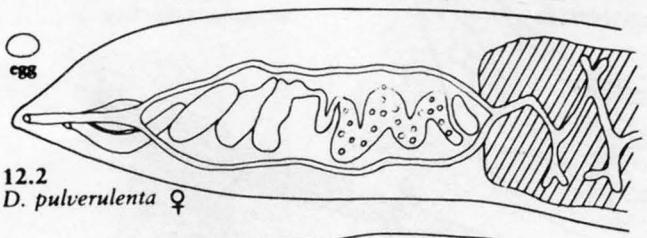


11.4 *B. polonica* ♀

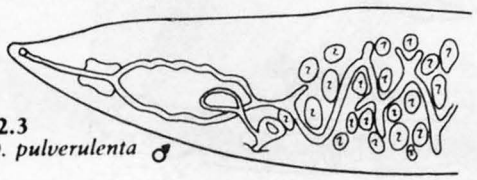
Fig. 11. Genus *Bilharziella*



12.1 *D. asiaticus*



12.2
D. pulverulenta ♀



12.3
D. pulverulenta ♂

Fig. 12. Genus *Dendritobilharzia*

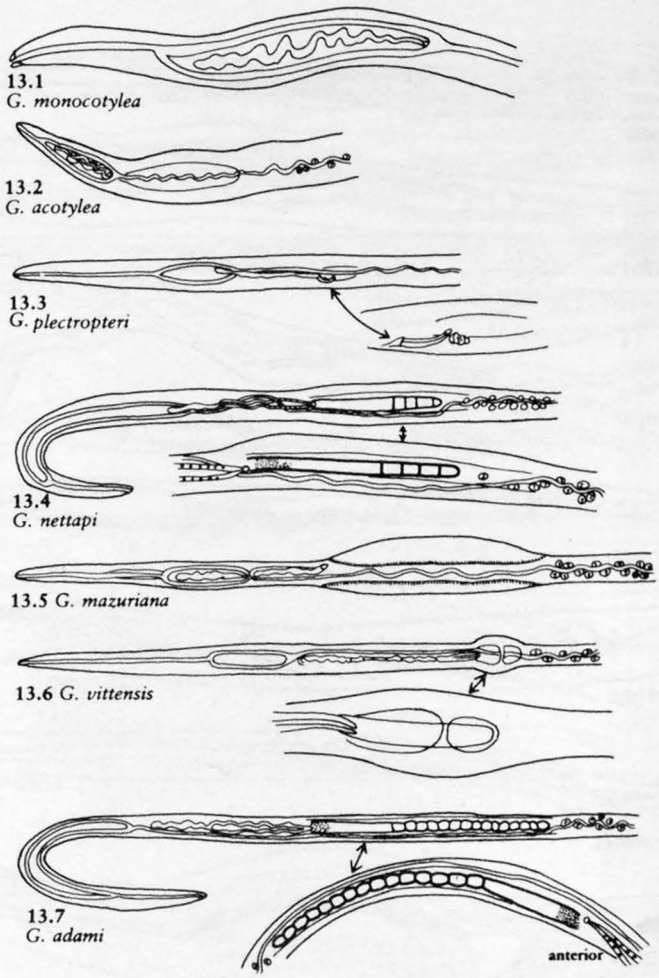


Fig. 13. Genus *Gigantobilharzia*

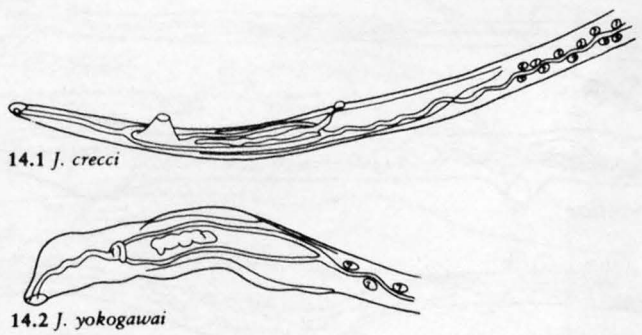


Fig. 14. Genus *Jilinobilharzia*

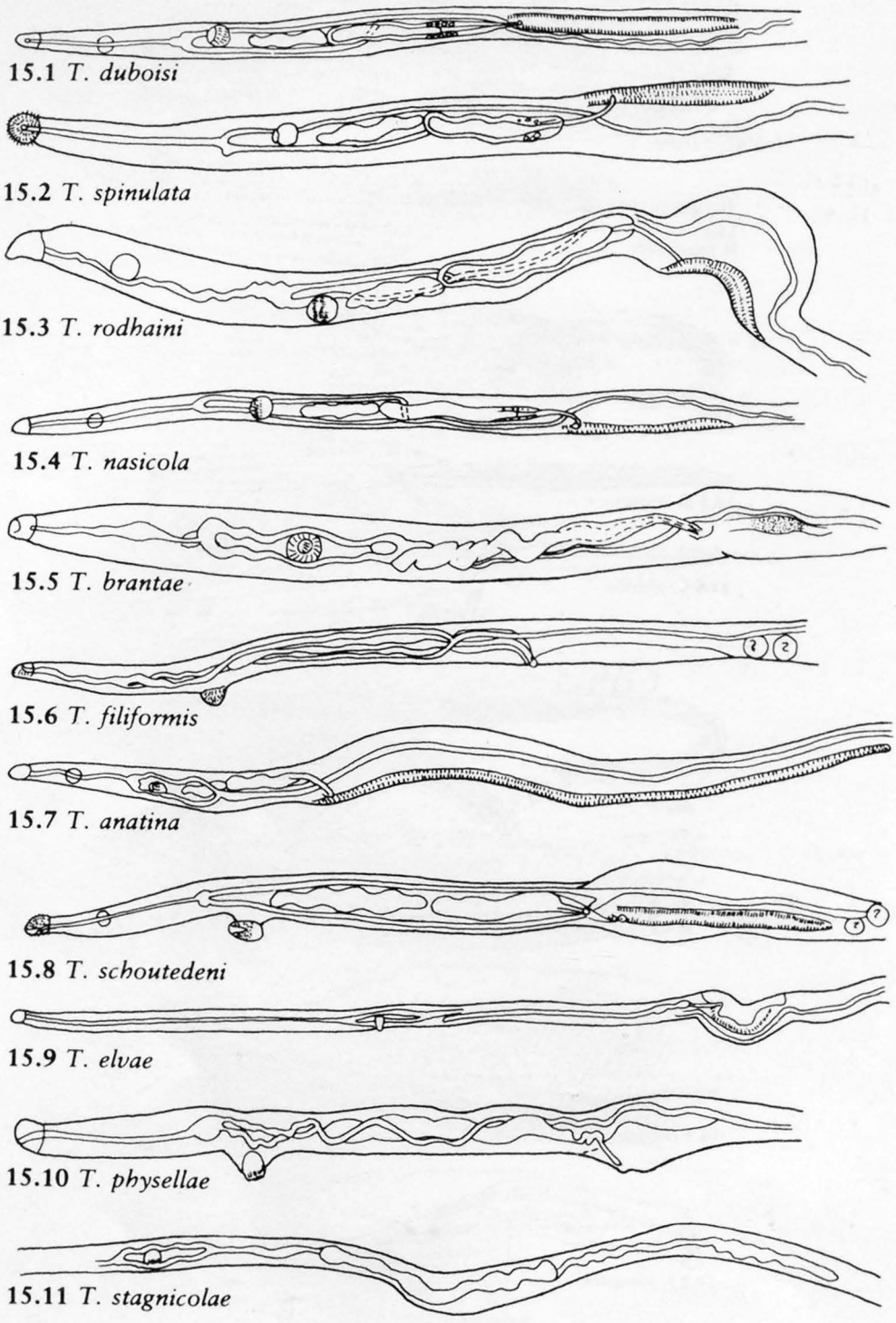


Fig. 15. Genus *Trichobilharzia*

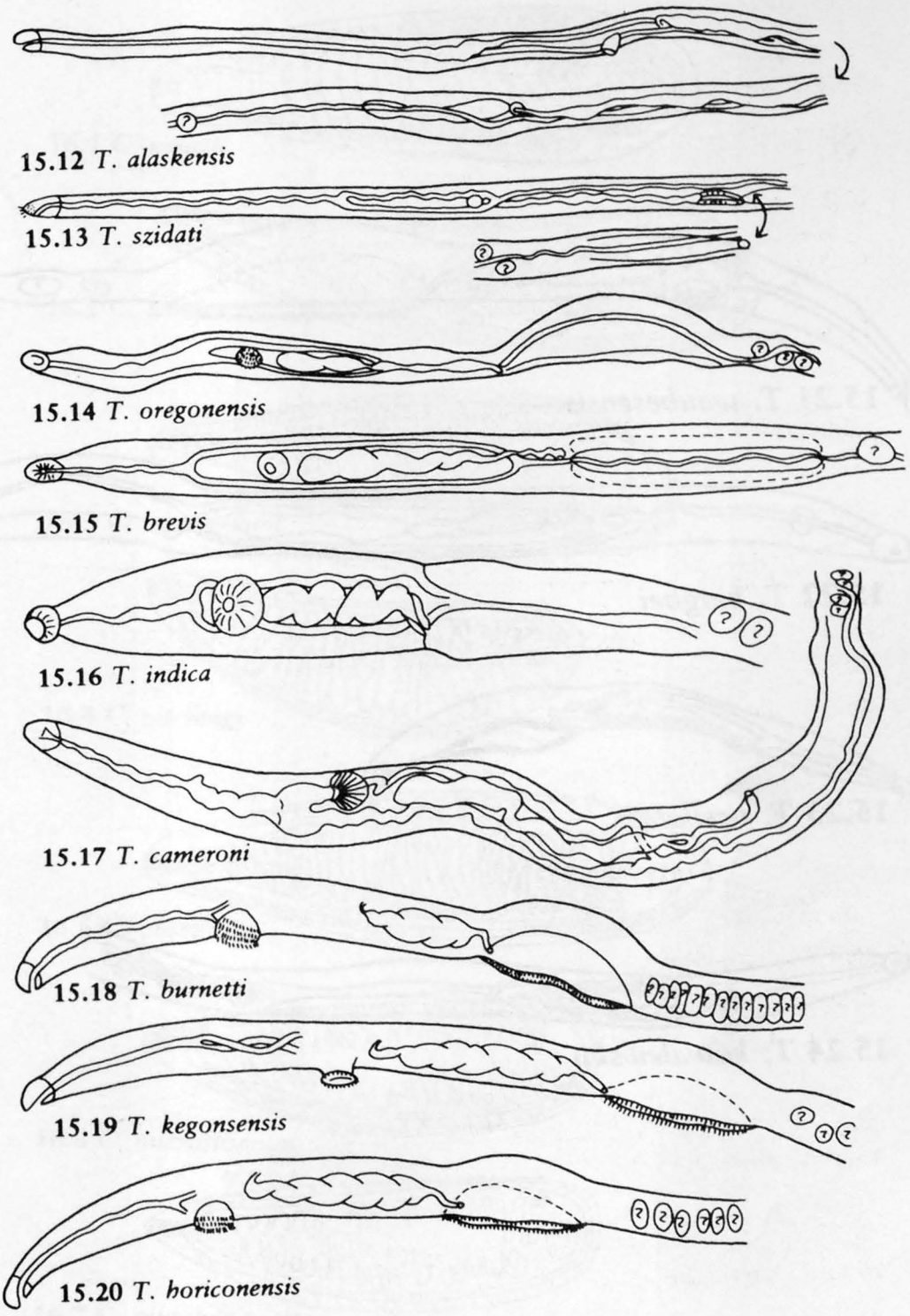
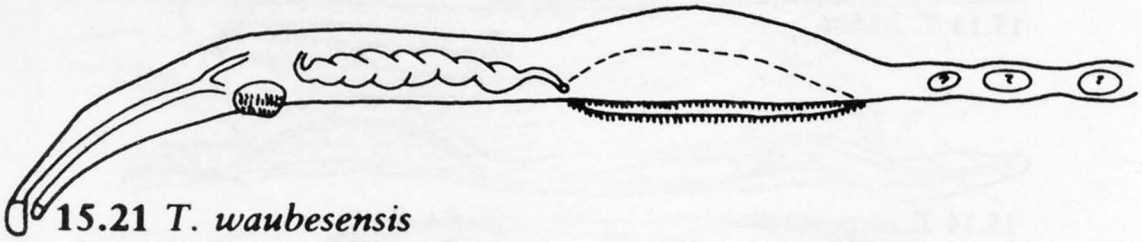
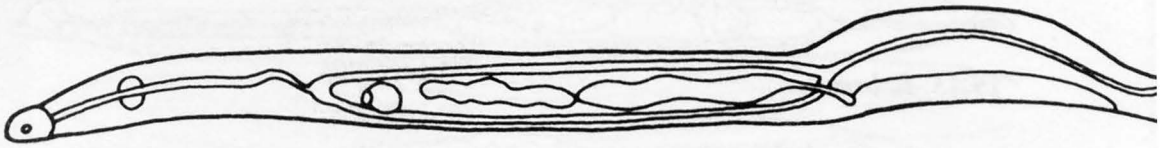


Fig. 15. Genus *Trichobilharzia* (cont. - 2)



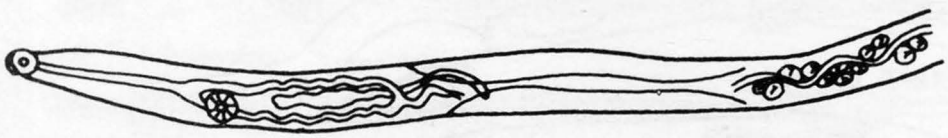
15.21 *T. waubesensis*



15.22 *T. berghei*

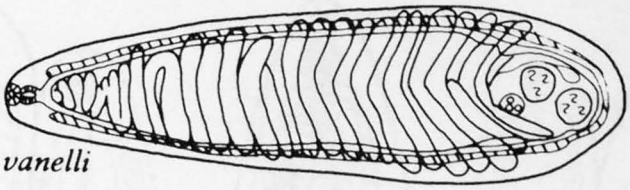


15.23 *T. ocellata*

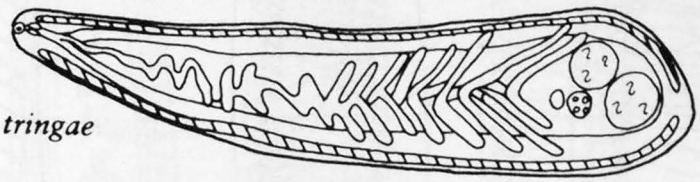


15.24 *T. kowalewskii*

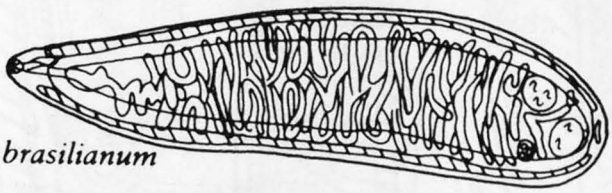
Fig. 15. Genus *Trichobilharzia* (cont. - 3)



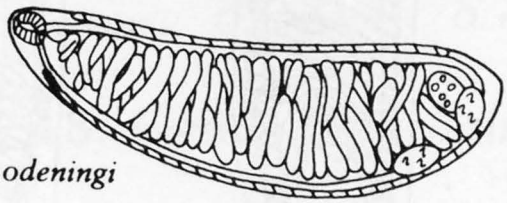
16.1 *C. vanelli*



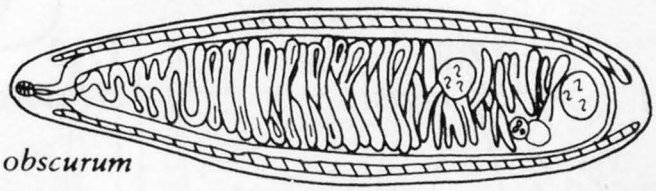
16.2 *C. tringae*



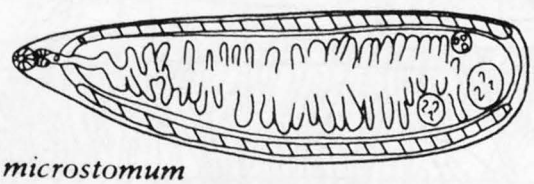
16.3 *C. brasilianum*



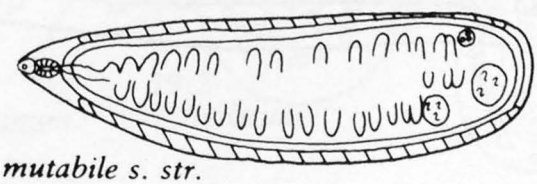
16.4 *C. odeningi*



16.5 *C. obscurum*

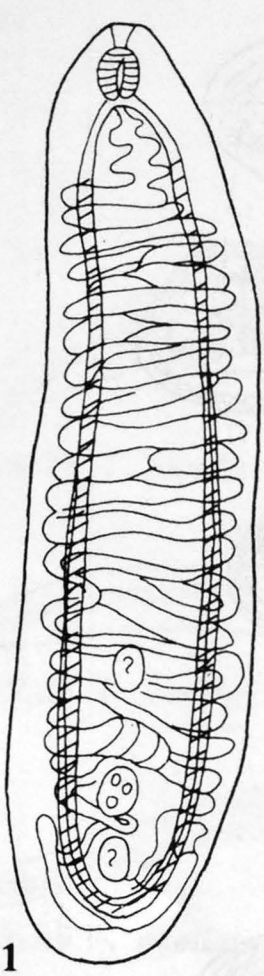


16.6 *C. microstomum*

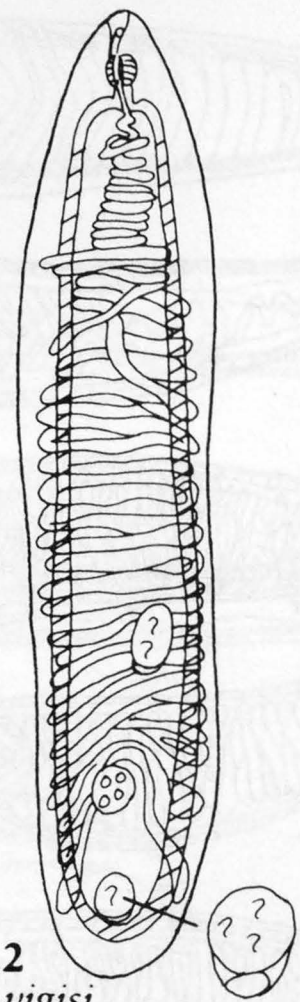


16.7 *C. mutabile s. str.*

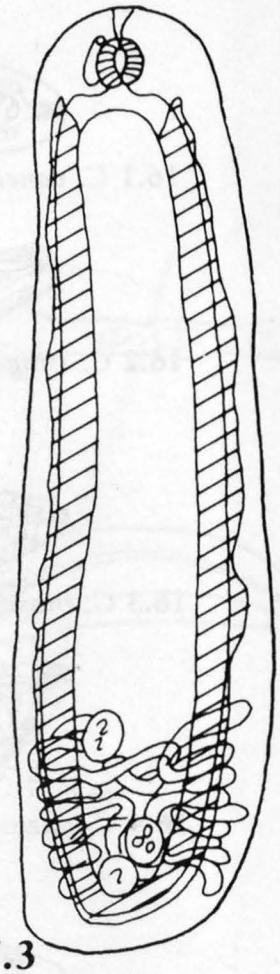
Fig. 16. Genus *Cyclocoelum*



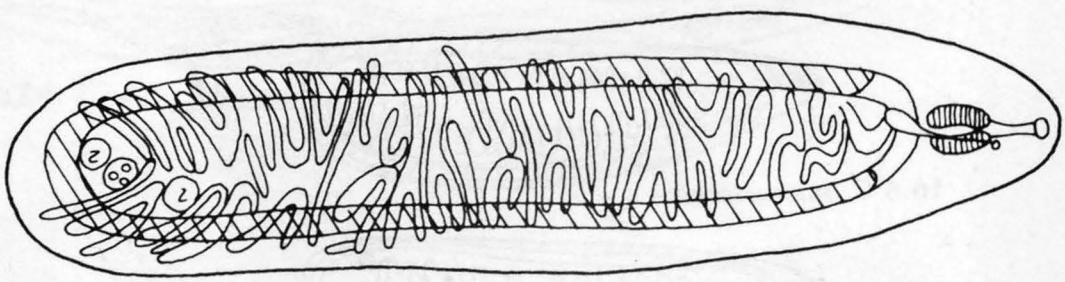
17.1
H. oculeus



17.2
H. vigisi



17.3
H. witenbergi



17.4
H. arcuatus

Fig. 17. Genus *Hyptiasmus*

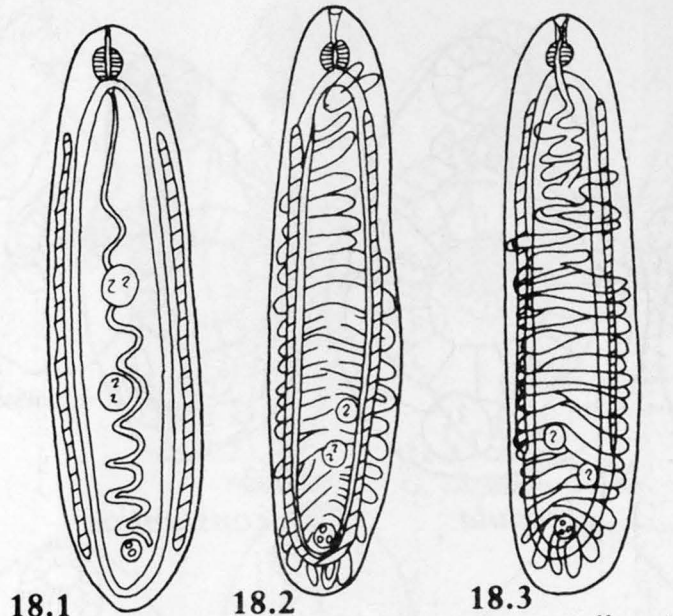


Fig. 18. Genus *Ophthalmophagus*

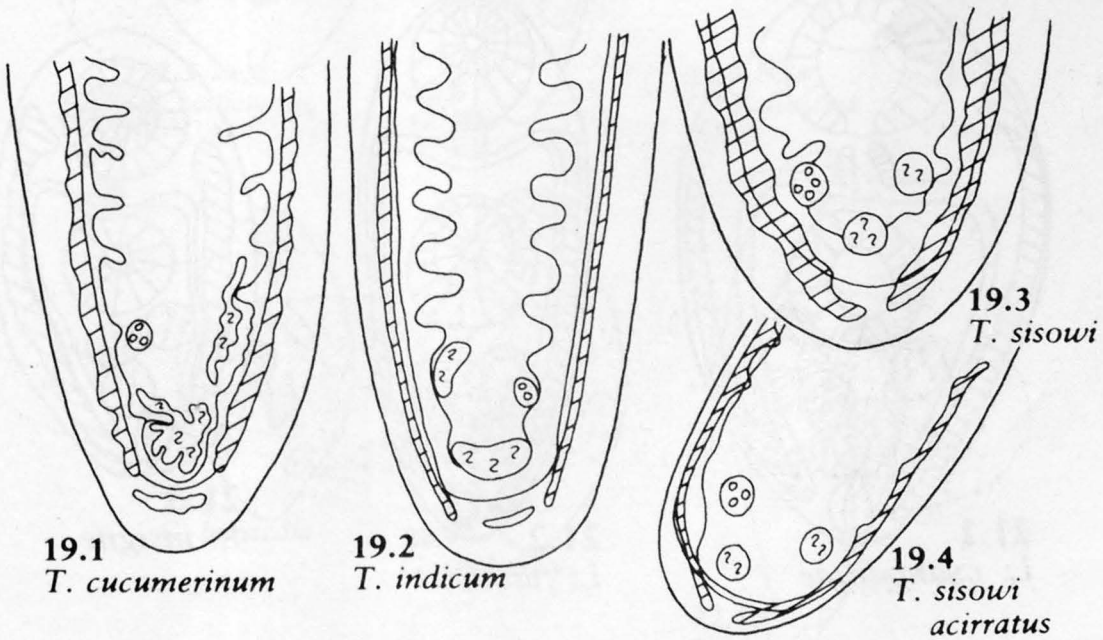


Fig. 19. Genus *Typhlocoelum*

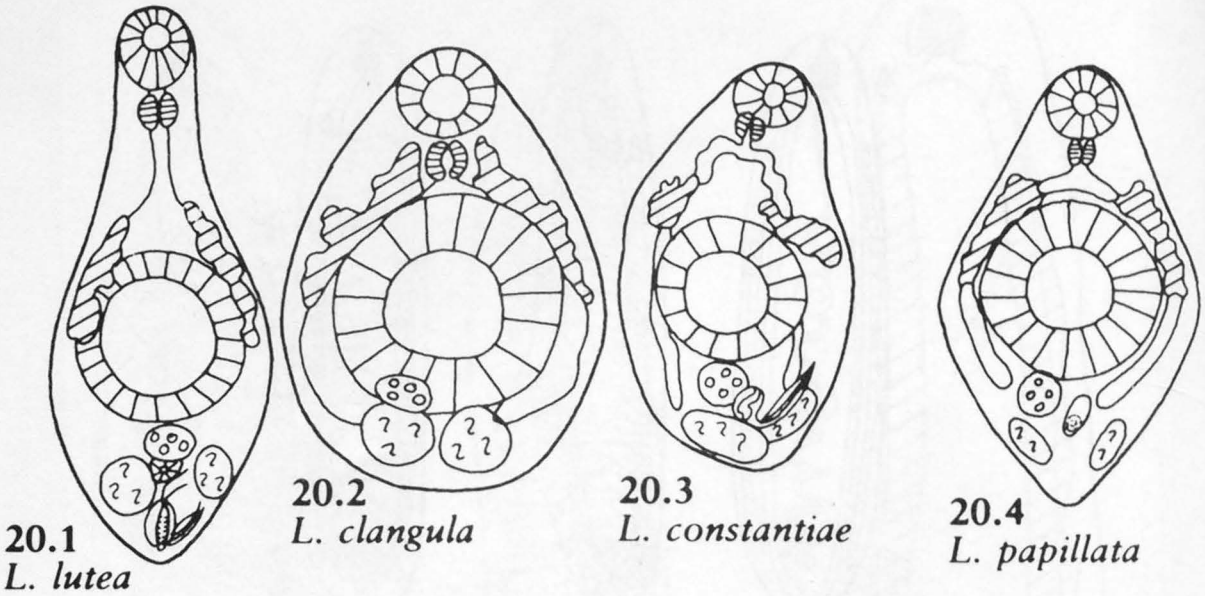


Fig. 20. Genus *Leucochloridiomorpha*

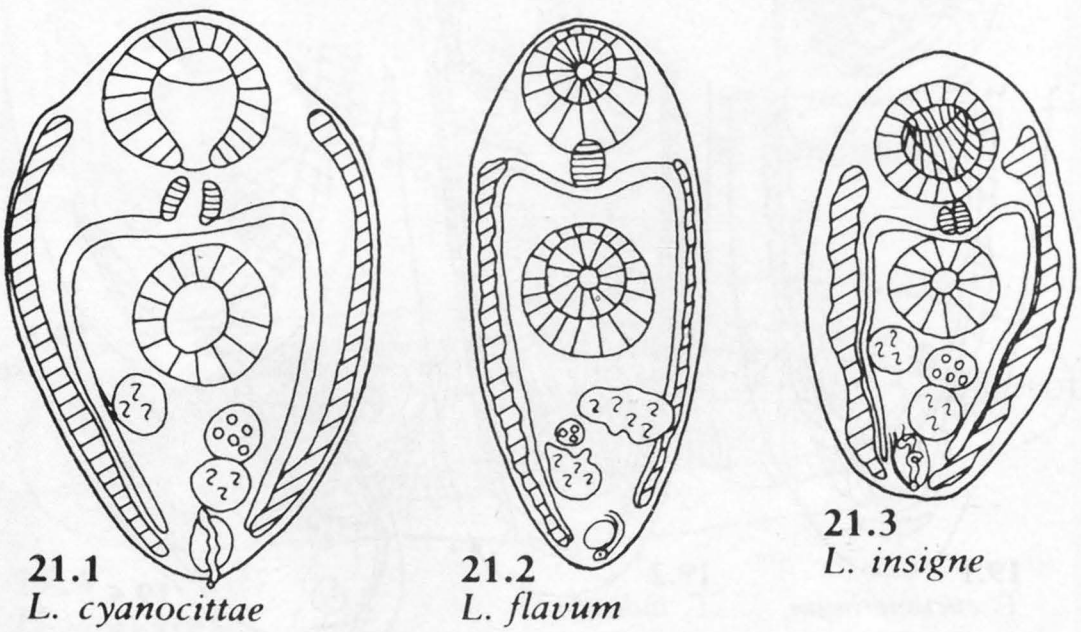


Fig. 21. Genus *Leucochloridum*

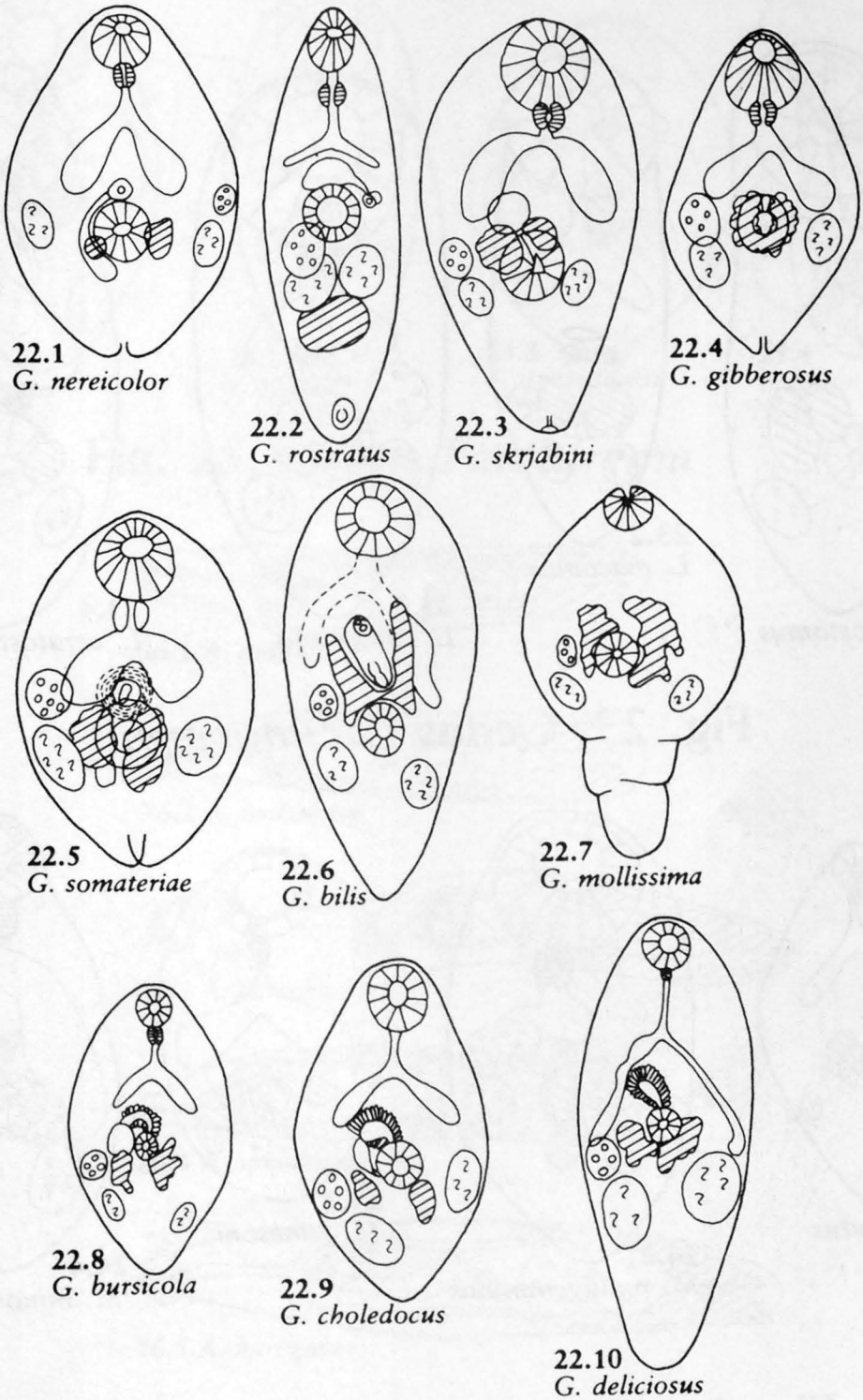


Fig. 22. Genus *Gymnophallus*

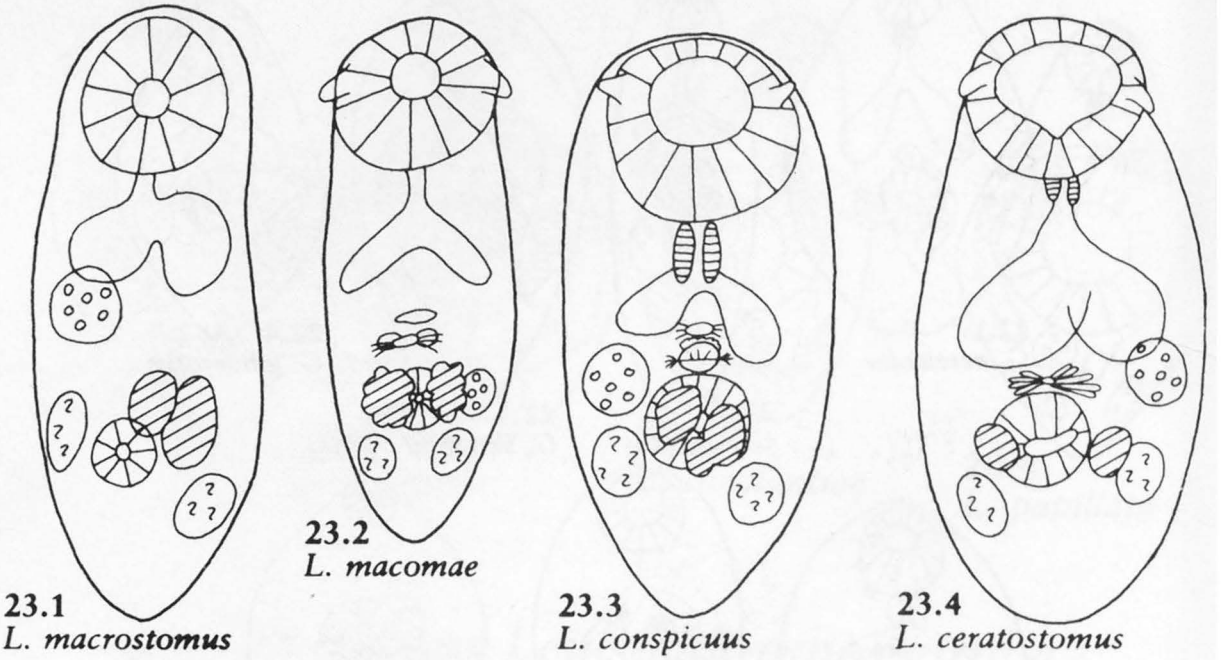


Fig. 23. Genus *Lacunovermis*

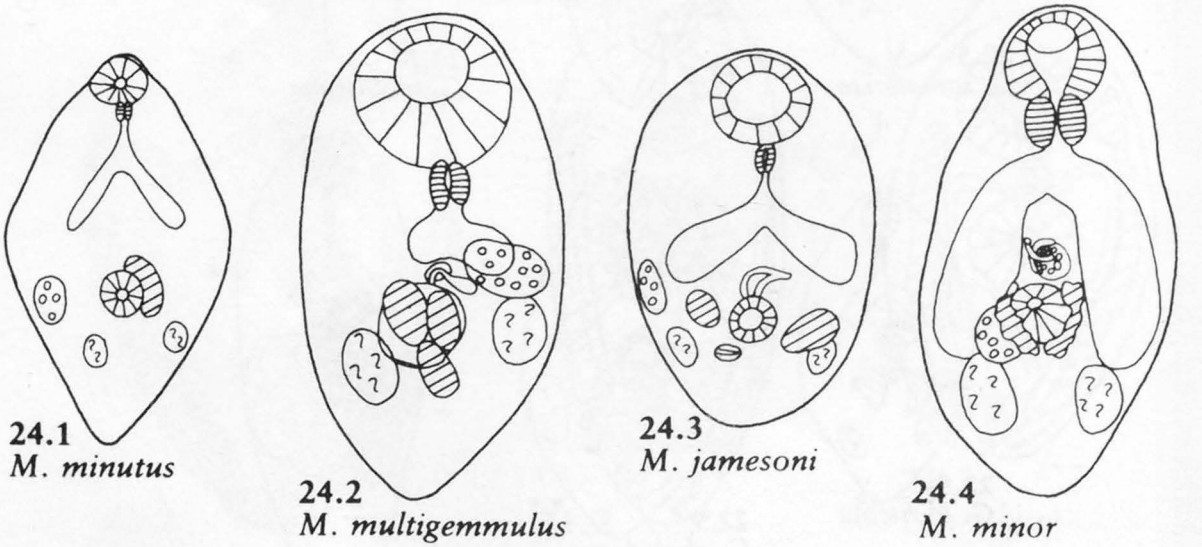


Fig. 24. Genus *Meiogymnophallus*

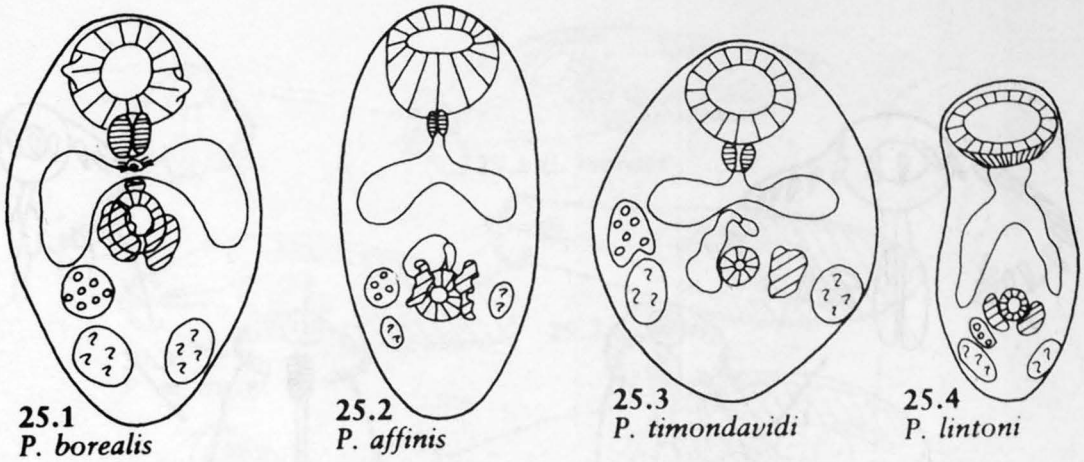


Fig. 25. Genus *Parvatrema*

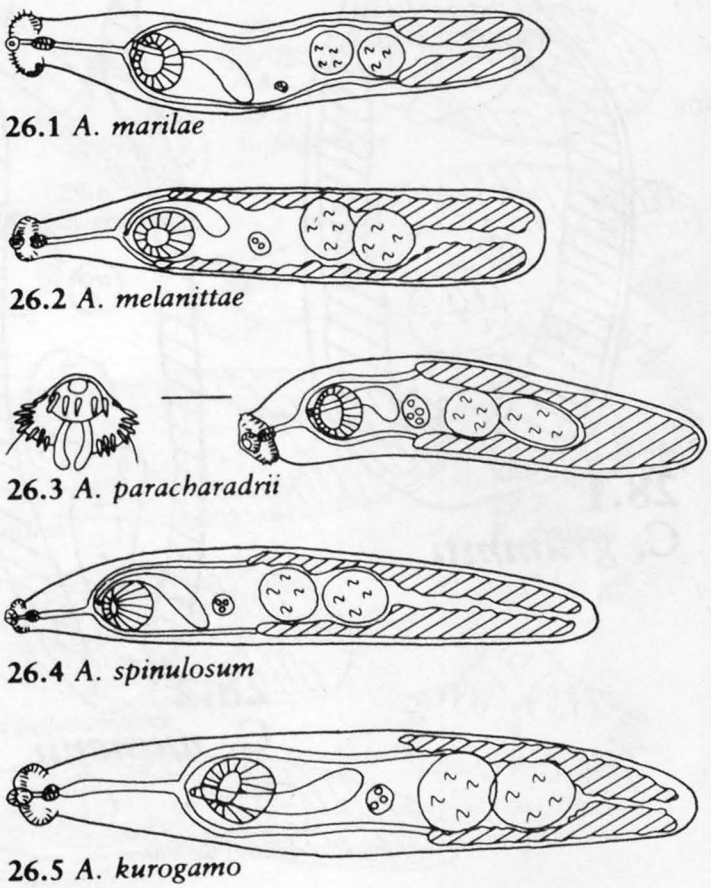


Fig. 26. Genus *Acanthoparyphium*

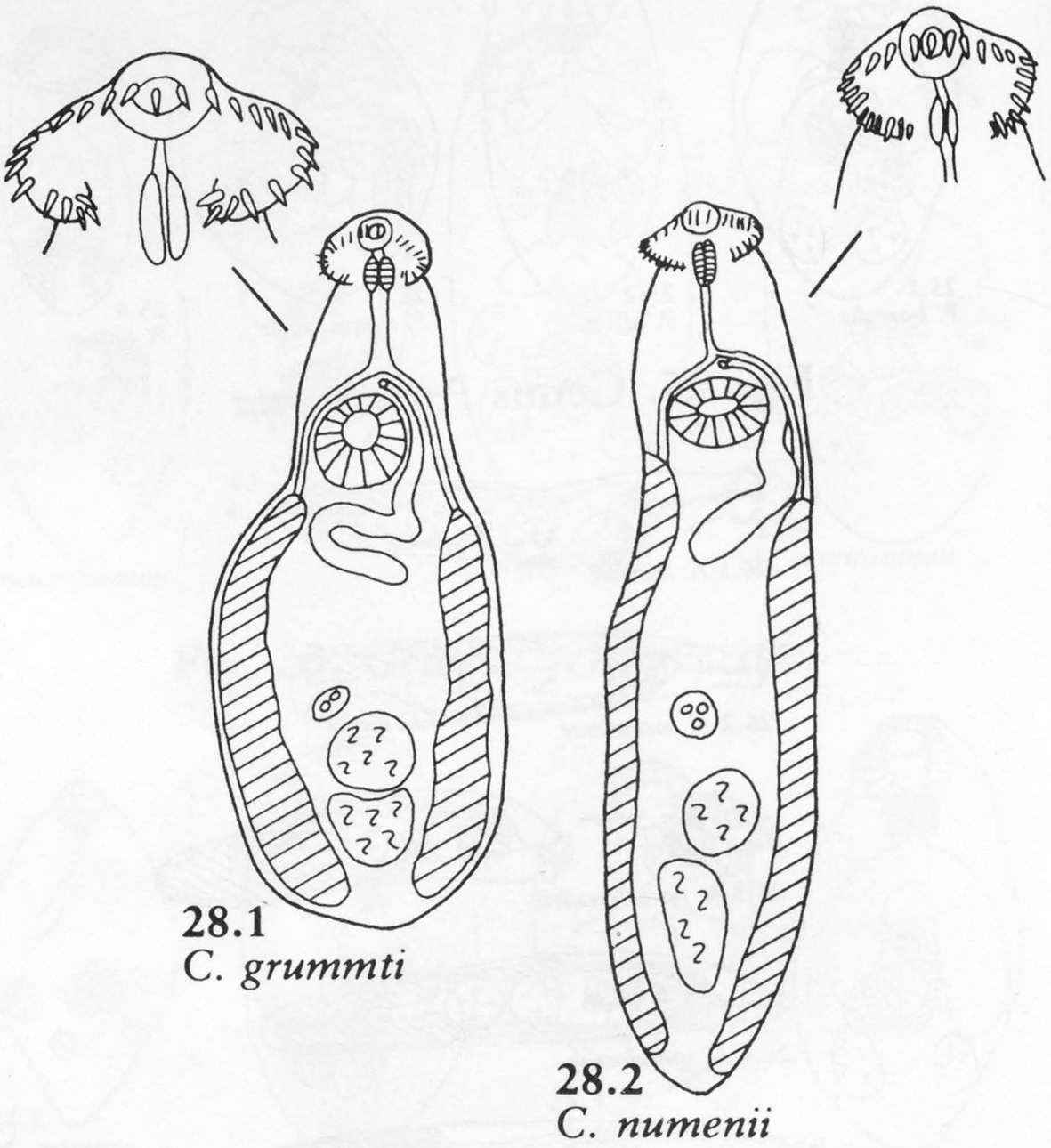


Fig. 27 was intentionally deleted by the author.

Fig. 28. Genus *Curtuteria*

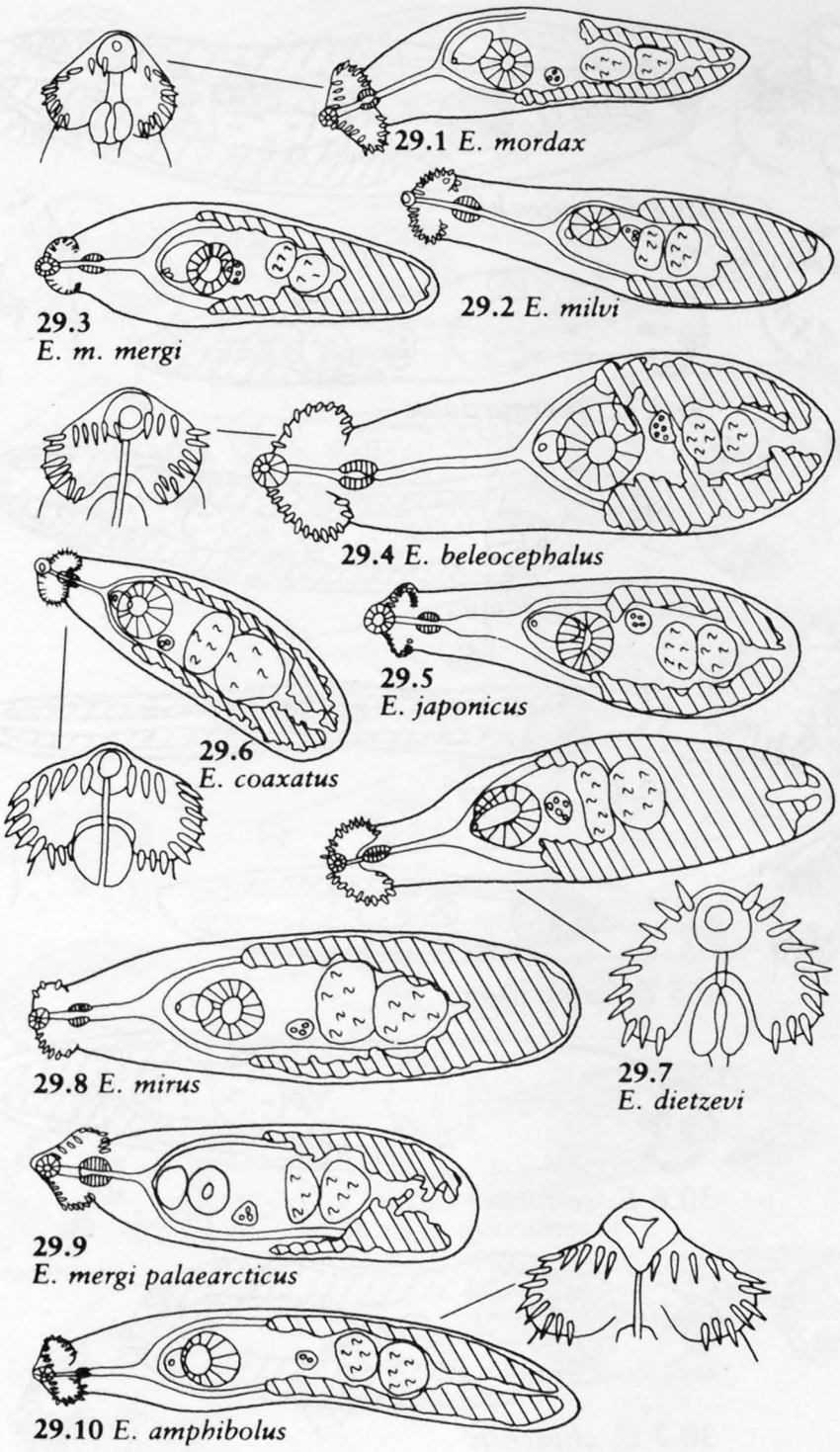
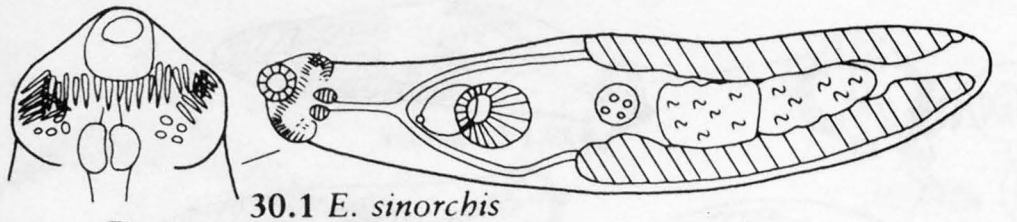
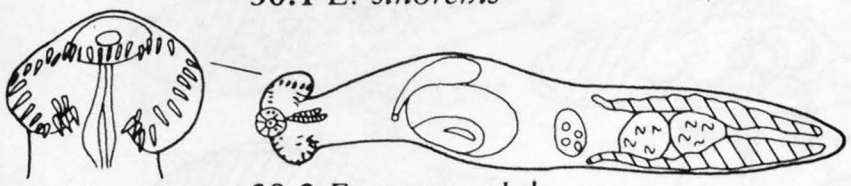


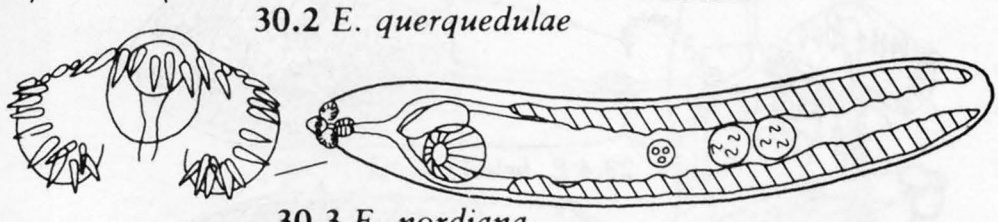
Fig. 29. Genus *Echinochasmus*



30.1 *E. sinorchis*



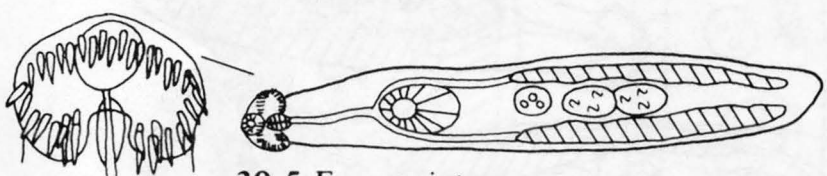
30.2 *E. querquedulae*



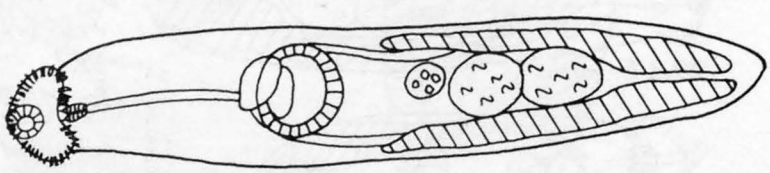
30.3 *E. nordiana*



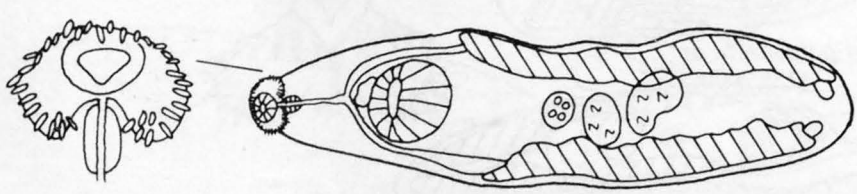
30.4 *E. politus*



30.5 *E. aconiatum*



30.6 *E. serratum*



30.7 *E. chinensis*

Fig. 30. Genus *Echinoparyphium*

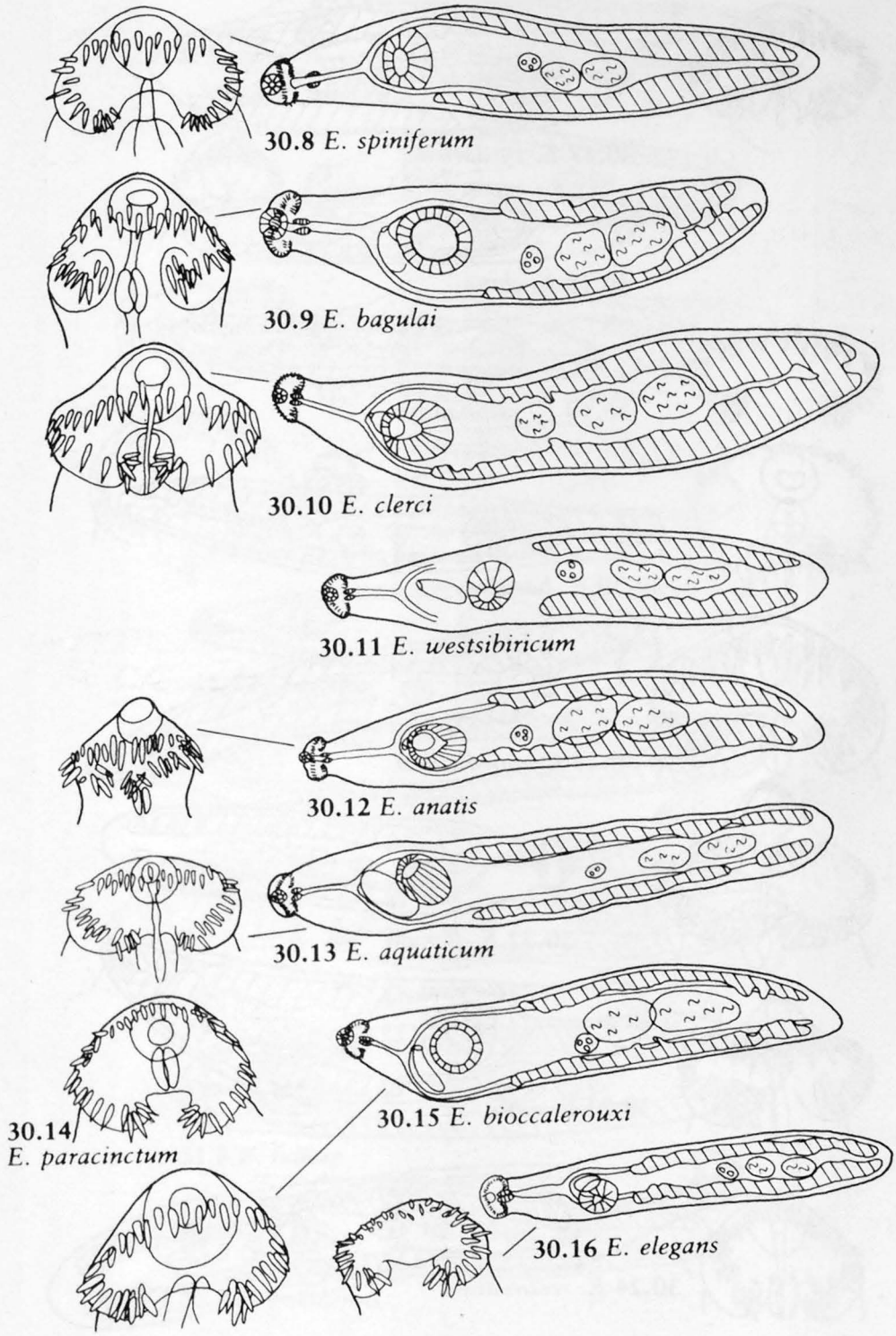


Fig. 30. Genus *Echinoparyphium* (cont. - 2)

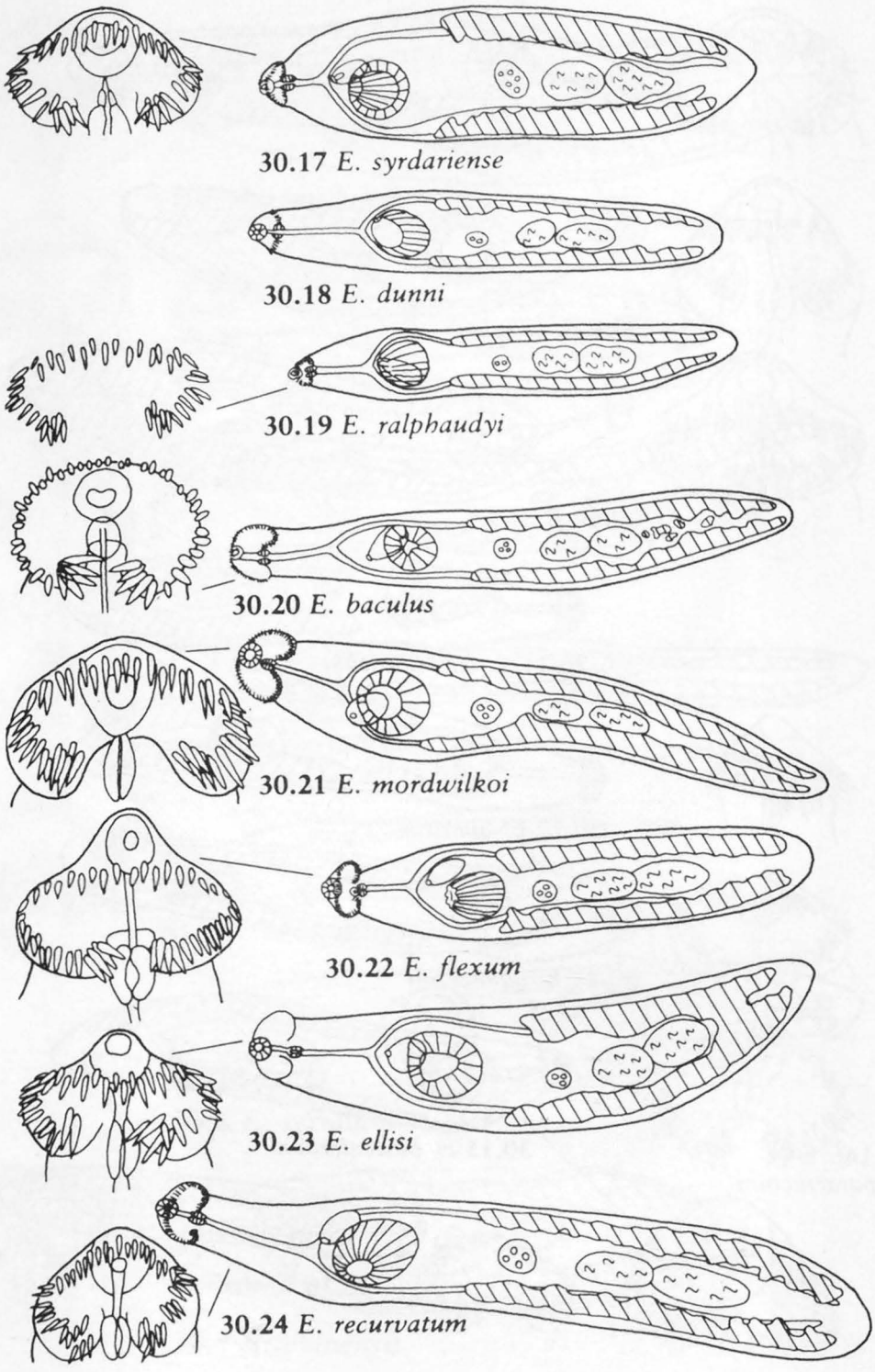
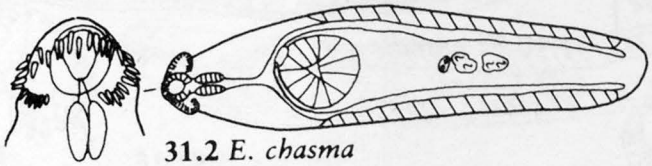


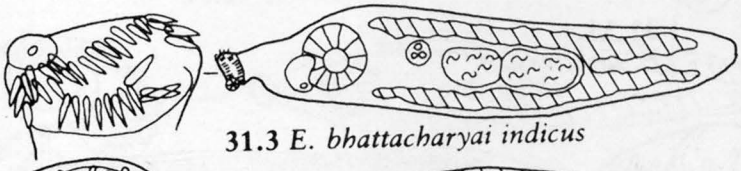
Fig. 30. Genus *Echinoparyphium* (cont. - 3)



31.1 *E. asiatica*



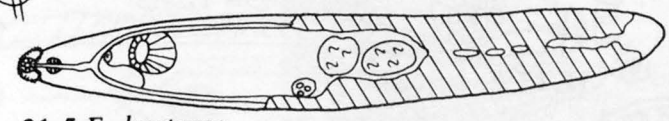
31.2 *E. chasma*



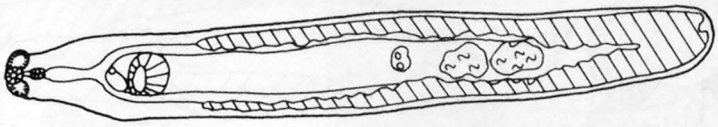
31.3 *E. bhattacharyai indicus*



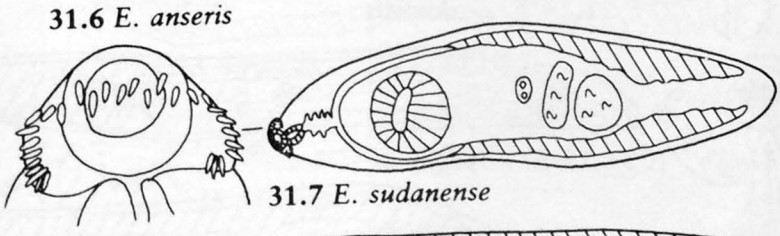
31.4 *E. koisarensis*



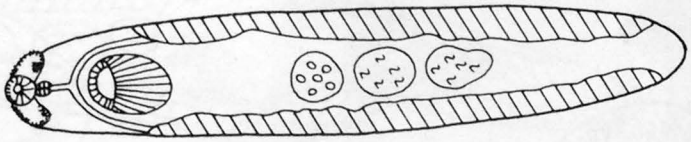
31.5 *E. hortense*



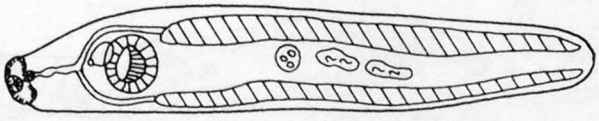
31.6 *E. anseris*



31.7 *E. sudanense*



31.8 *E. fulicae*



31.9 *E. pekinensis*

Fig. 31. Genus *Echinostoma*

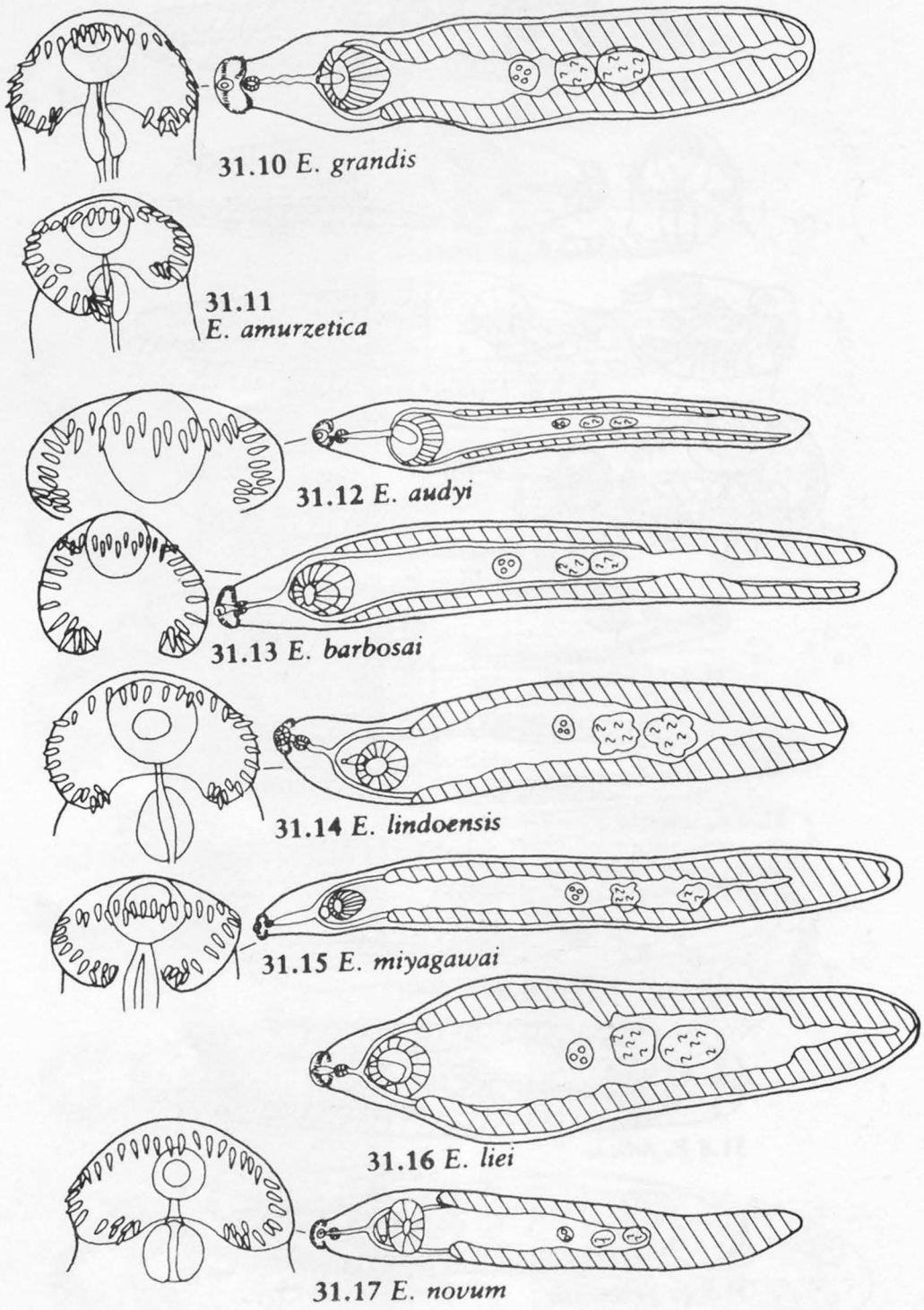


Fig. 31. Genus *Echinostoma* (cont. - 2)

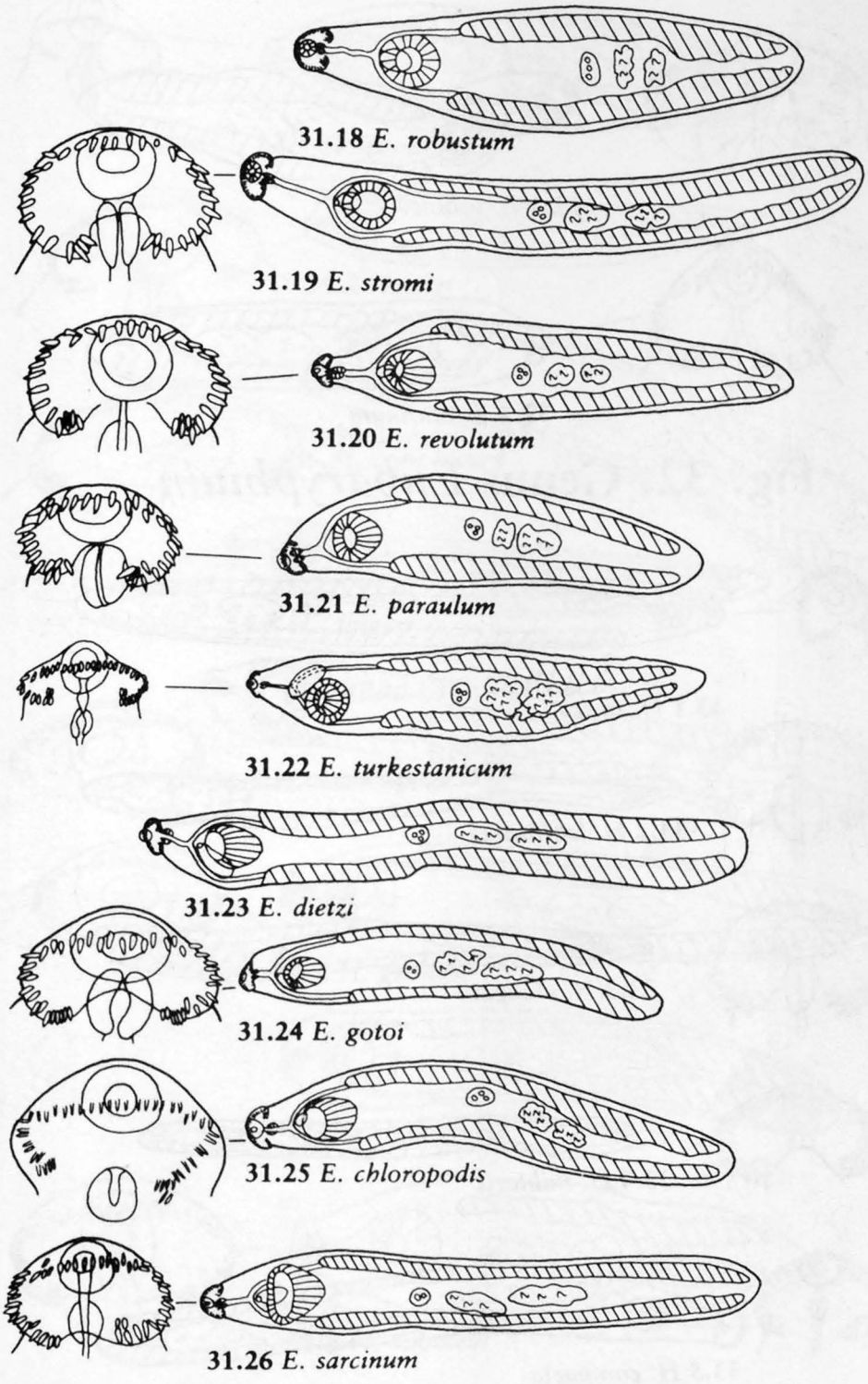
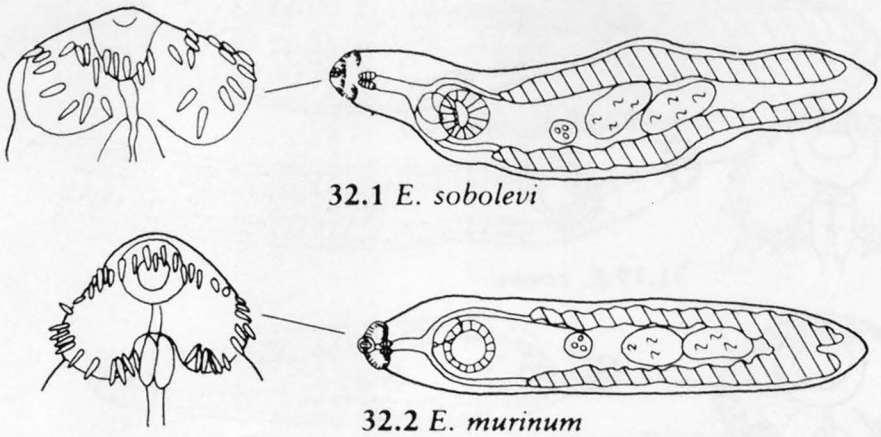


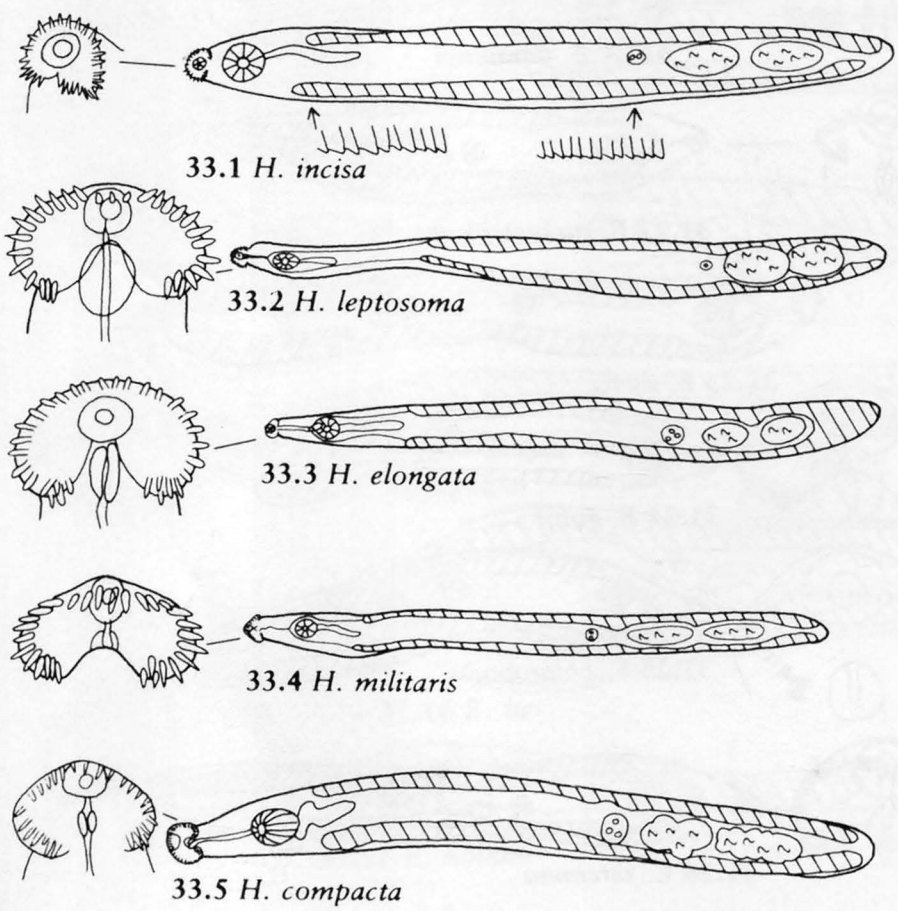
Fig. 31. Genus *Echinostoma* (cont. - 3)



32.1 *E. sobolevi*

32.2 *E. murinum*

Fig. 32. Genus *Euparyphium*



33.1 *H. incisa*

33.2 *H. leptosoma*

33.3 *H. elongata*

33.4 *H. militaris*

33.5 *H. compacta*

Fig. 33. Genus *Himasthla*

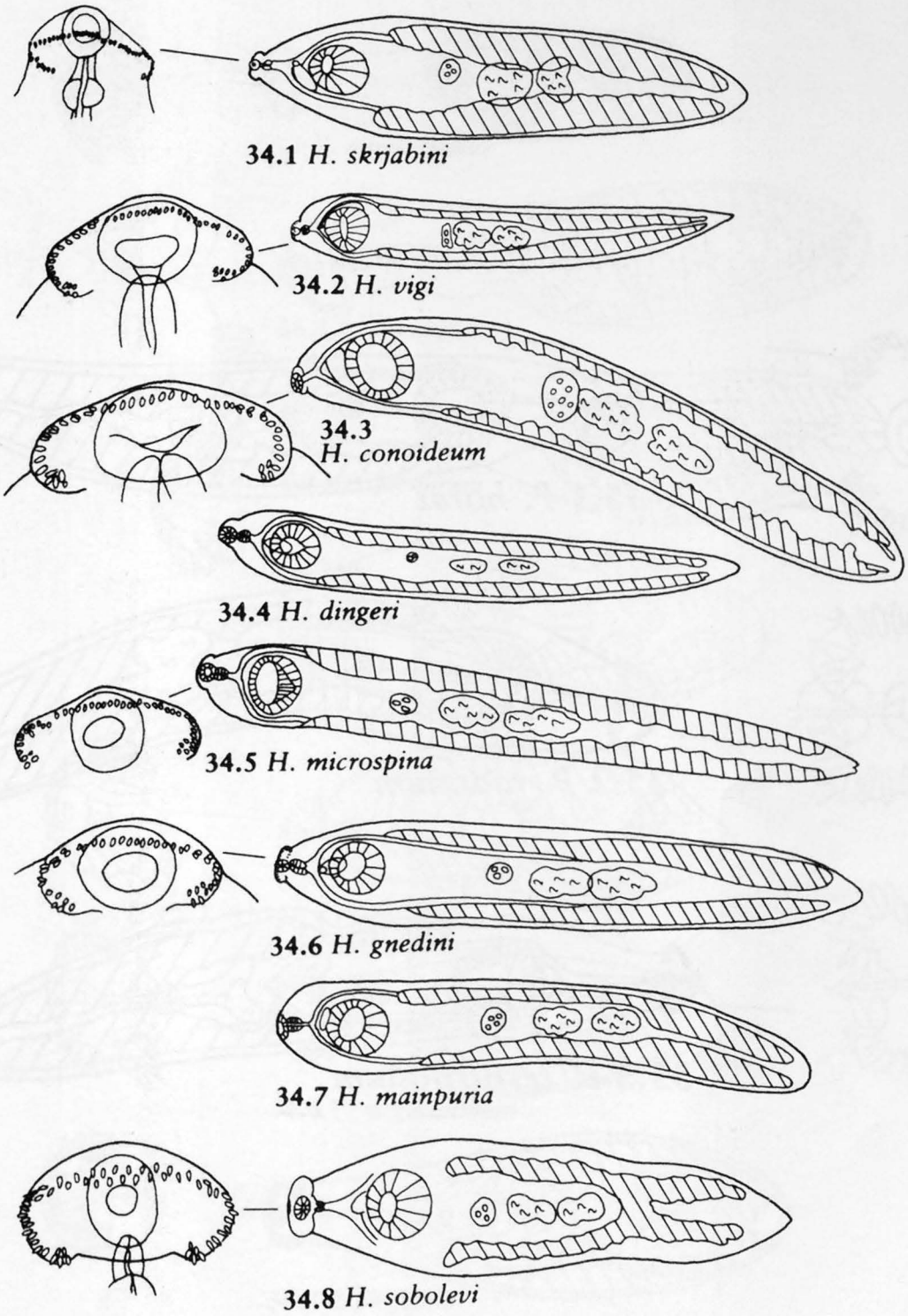


Fig. 34. Genus *Hypoderaeum*

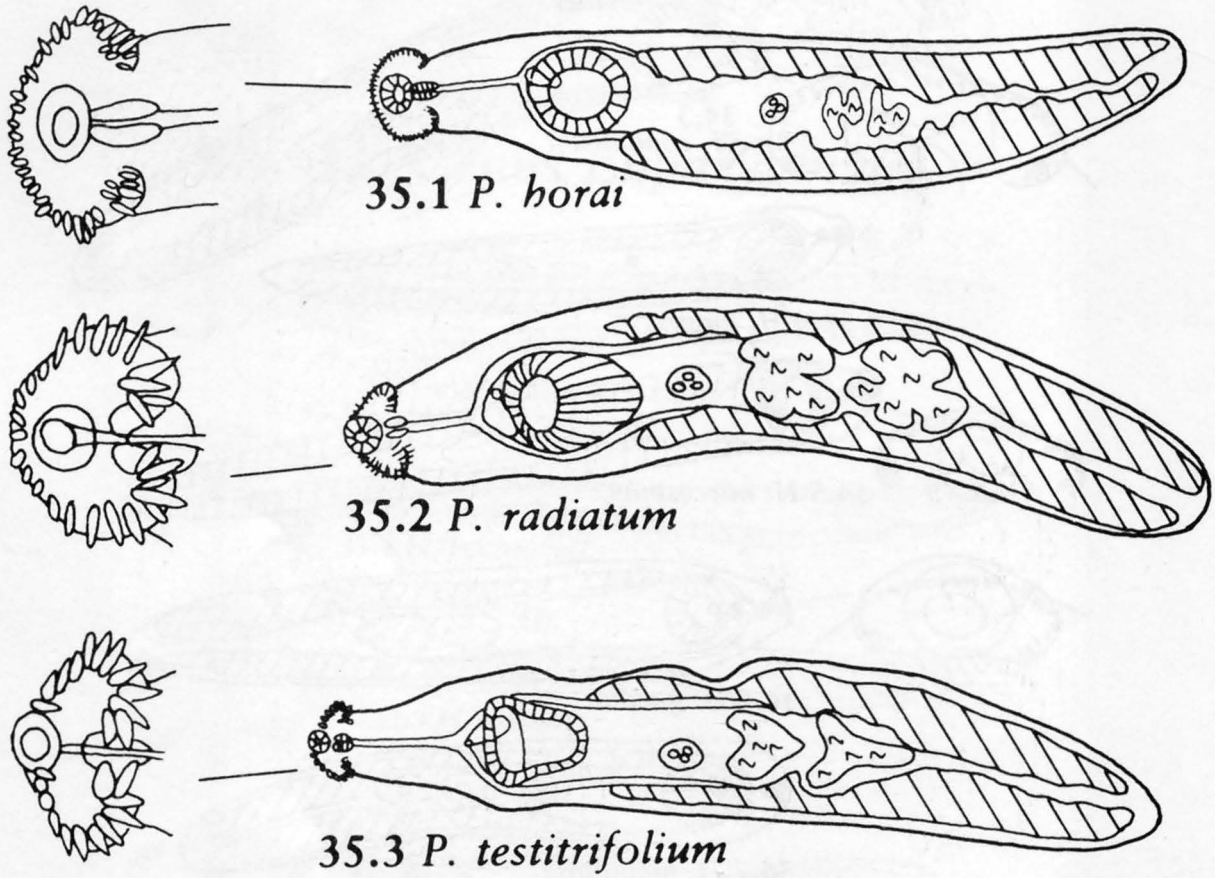


Fig. 35. Genus *Paryphostomum*

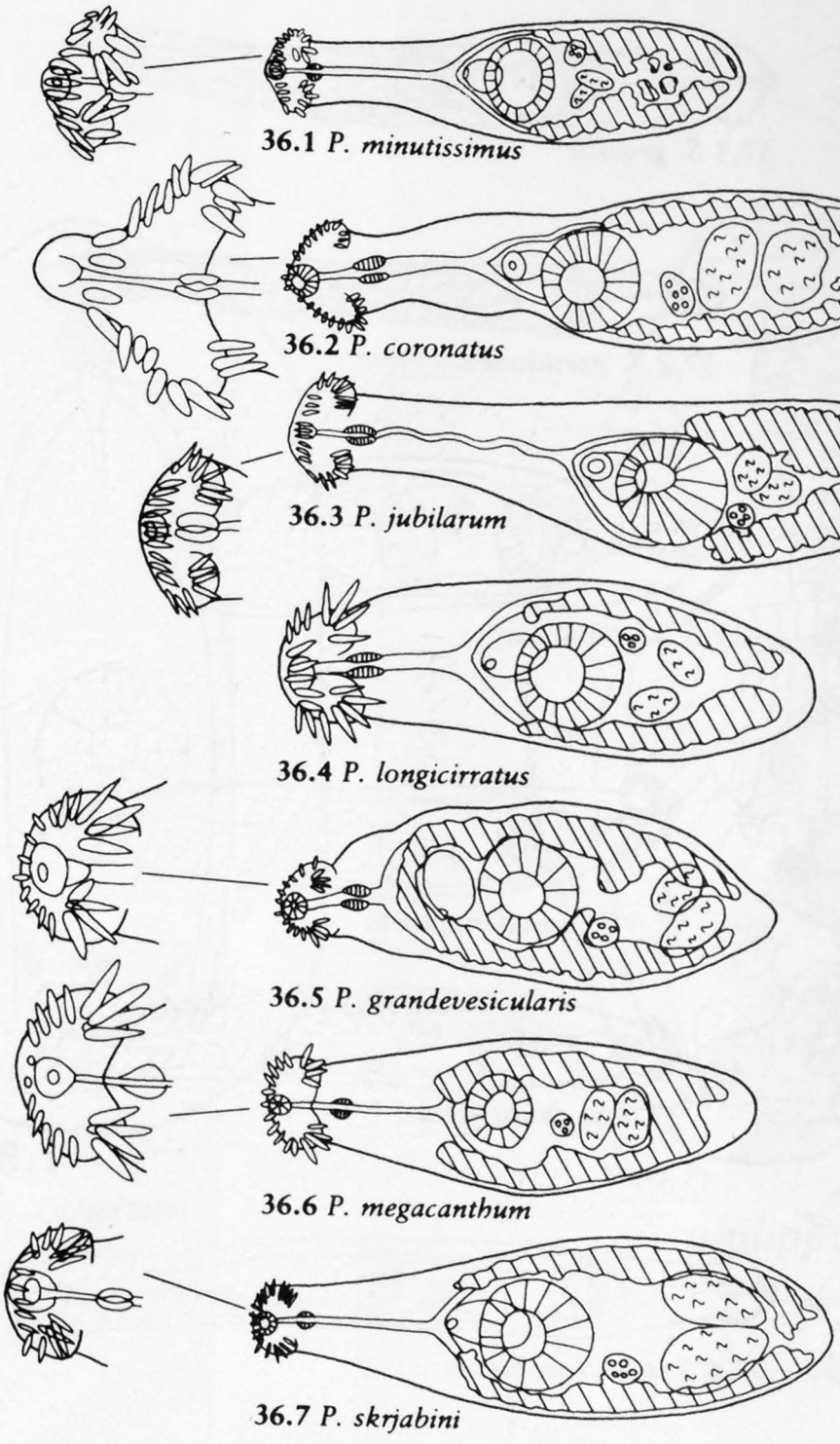


Fig. 36. Genus *Petasiger*

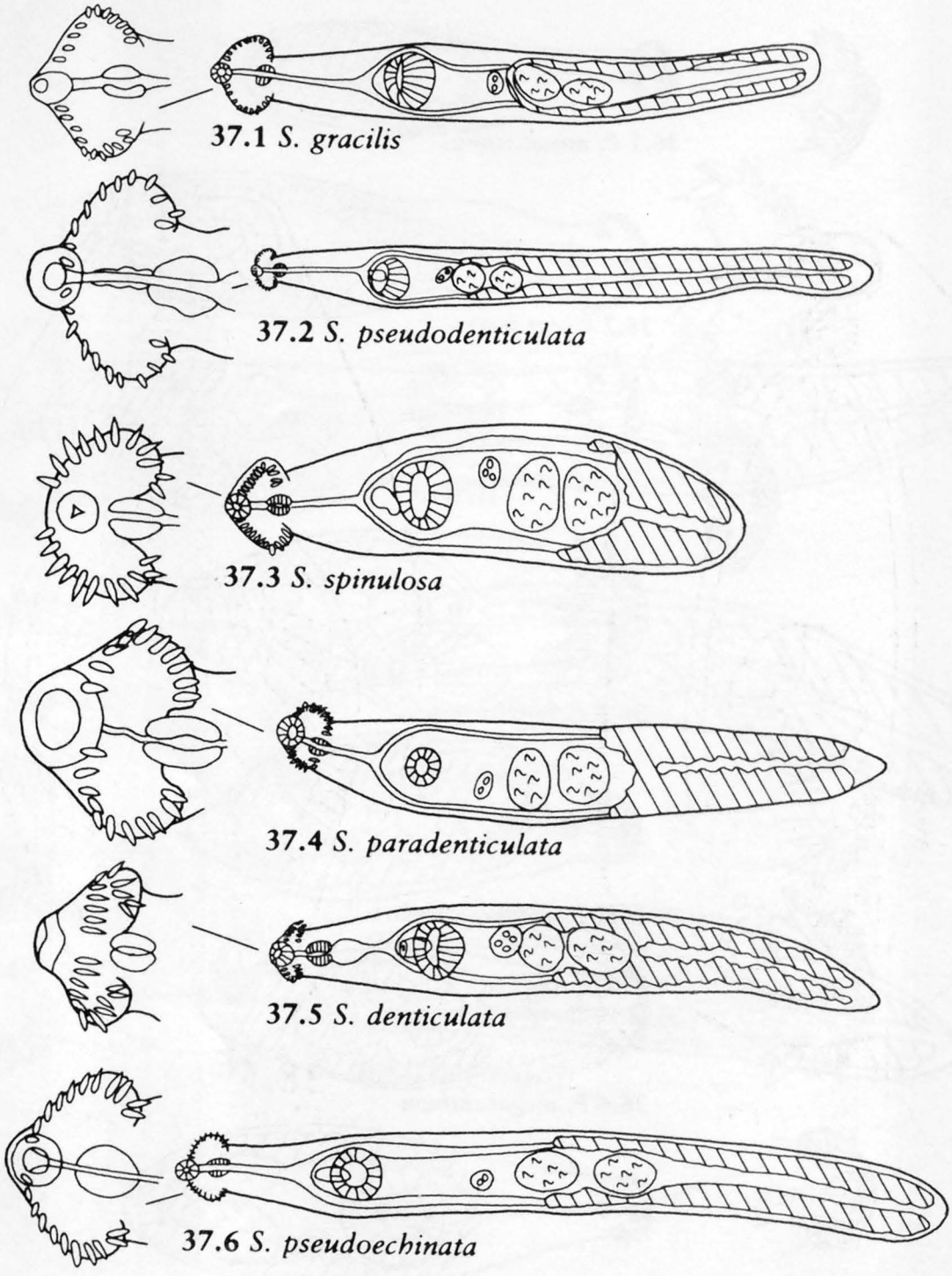
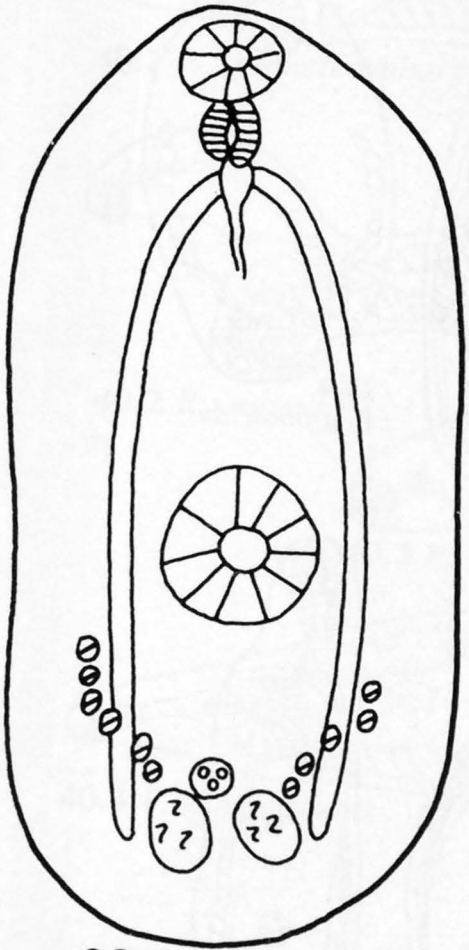
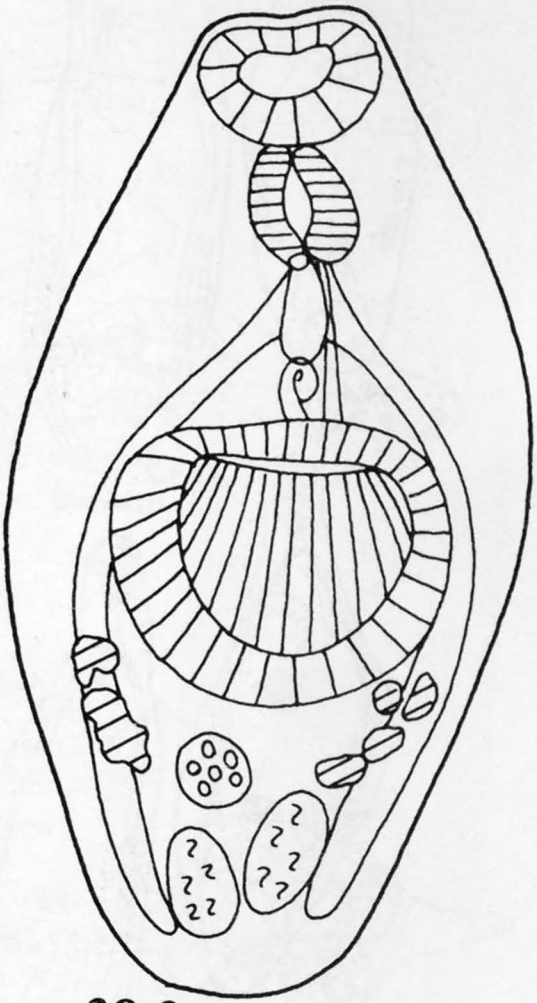


Fig. 37. Genus *Stephanoprova*



38.1
C. ovatum



38.2
C. philippinum

Fig. 38. Genus *Cloacitrema*

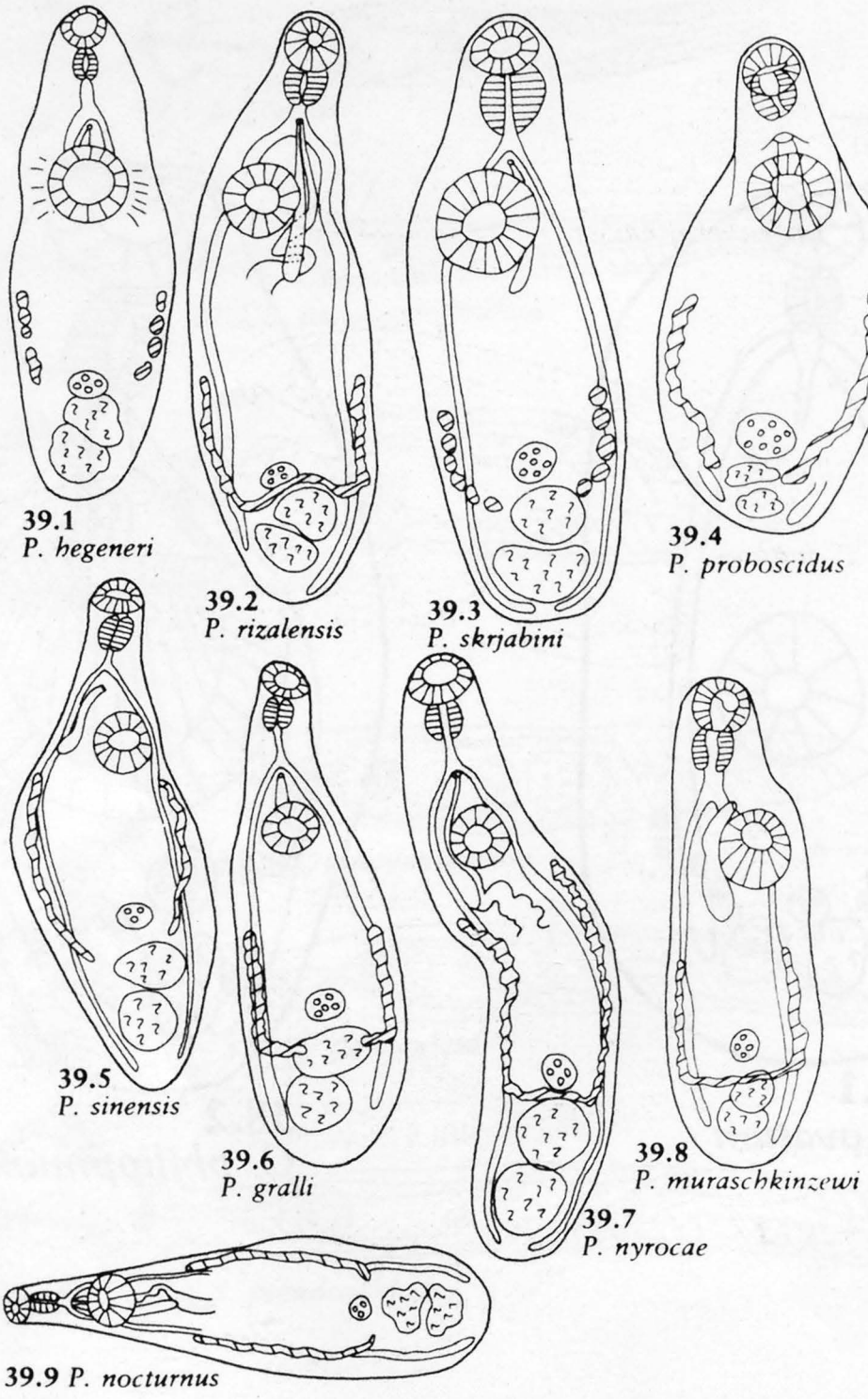
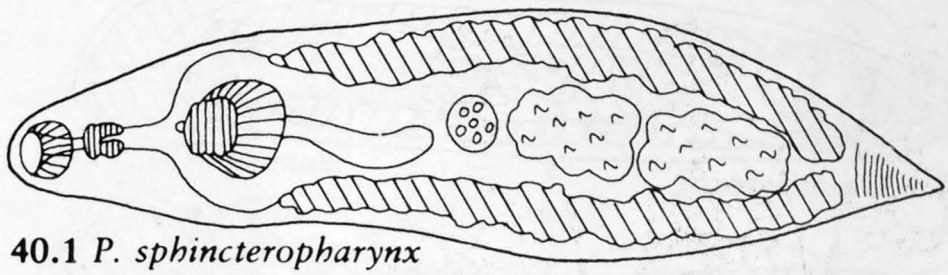
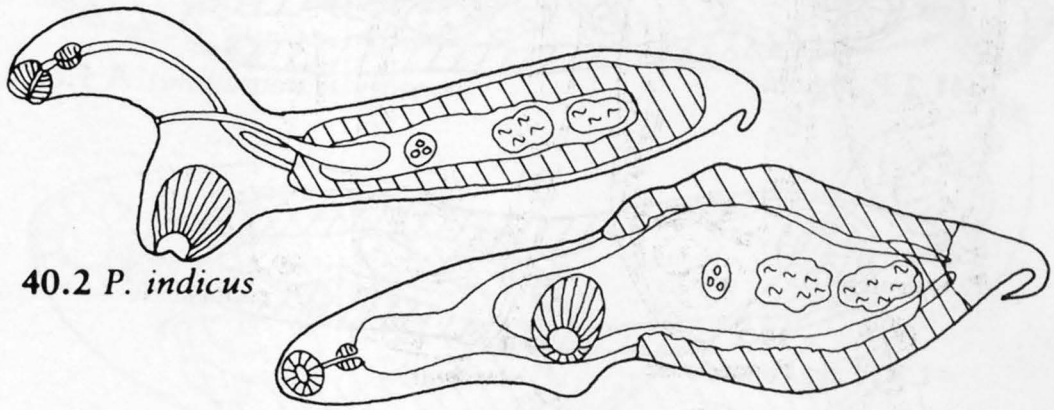


Fig. 39. Genus *Philophthalmus*

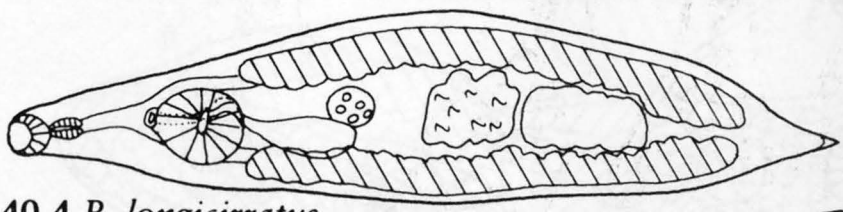


40.1 *P. sphincteropharynx*

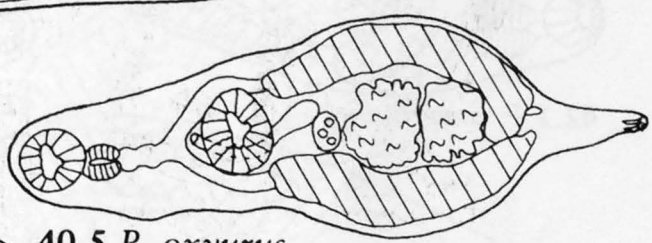


40.2 *P. indicus*

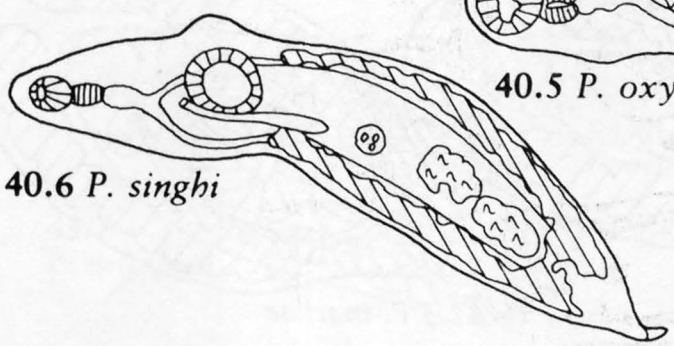
40.3 *P. alii*



40.4 *P. longicirratus*

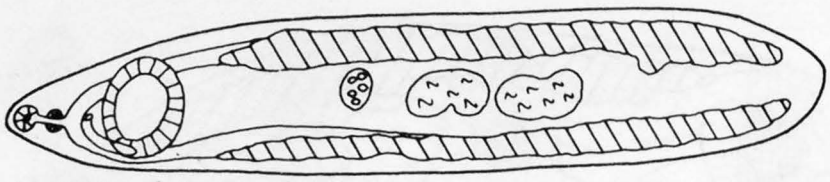


40.5 *P. oxyurus*

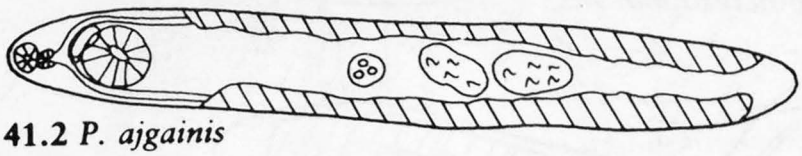


40.6 *P. singhi*

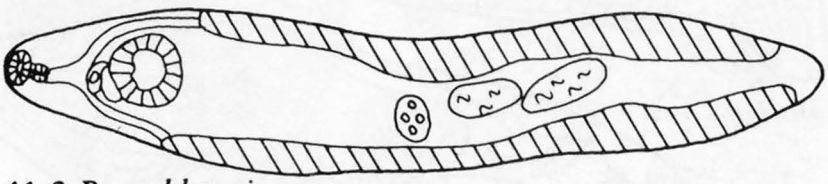
Fig. 40. Genus *Psilochasmus*



41.1 *P. udaipurensis*

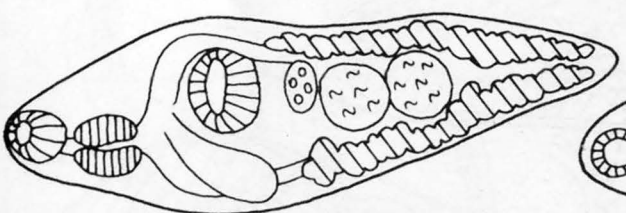


41.2 *P. ajgainis*

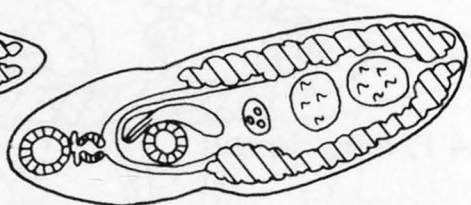


41.3 *P. seekhpari*

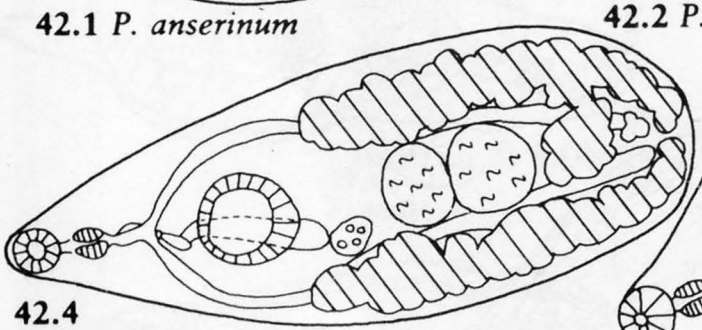
Fig. 41. Genus *Psilorchis*



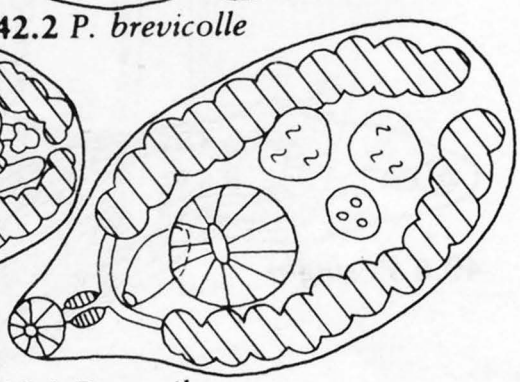
42.1 *P. anserinum*



42.2 *P. brevicolle*



42.4
P. borealis



42.3 *P. marilae*

Fig. 42. Genus *Psilostomum*

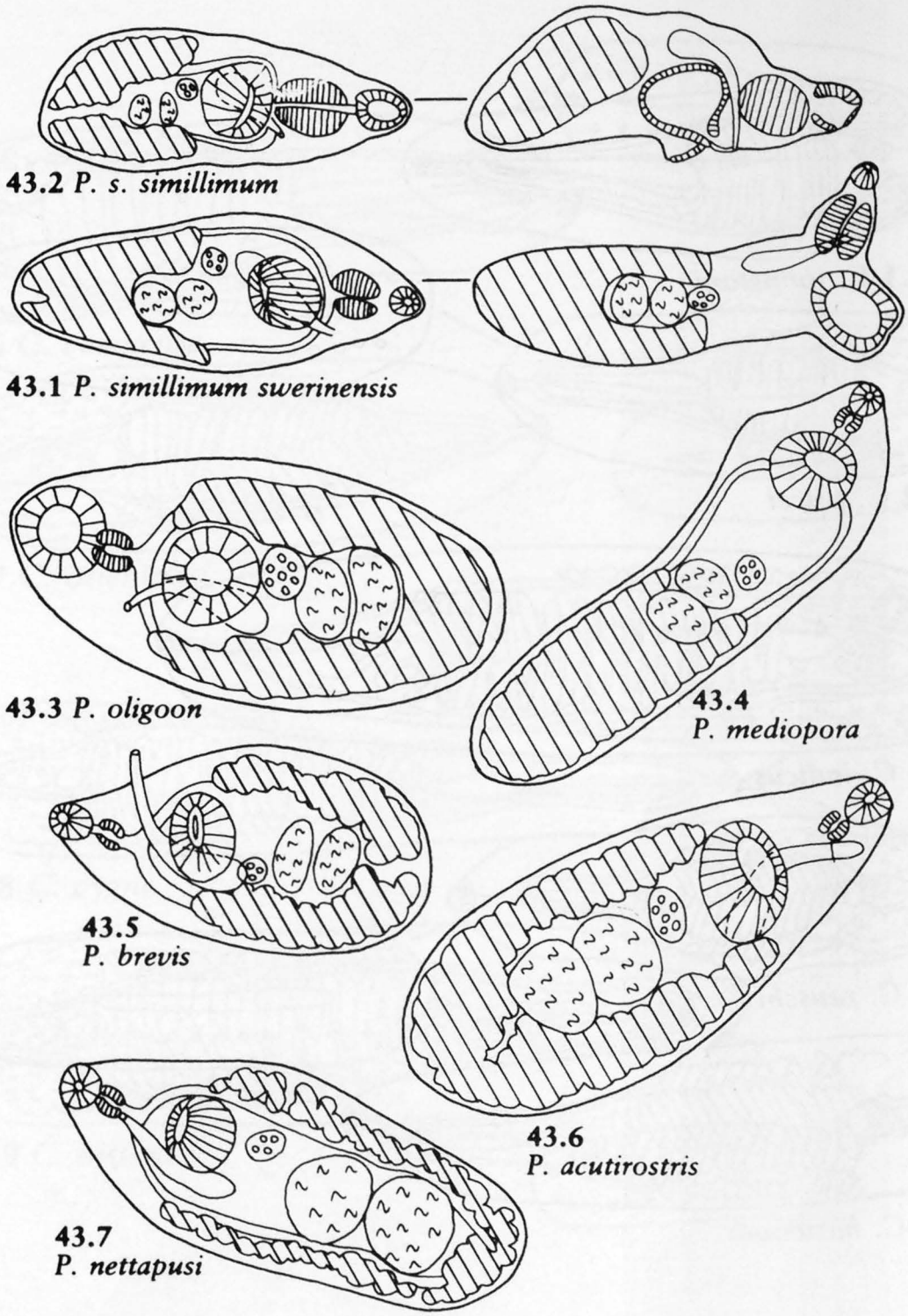
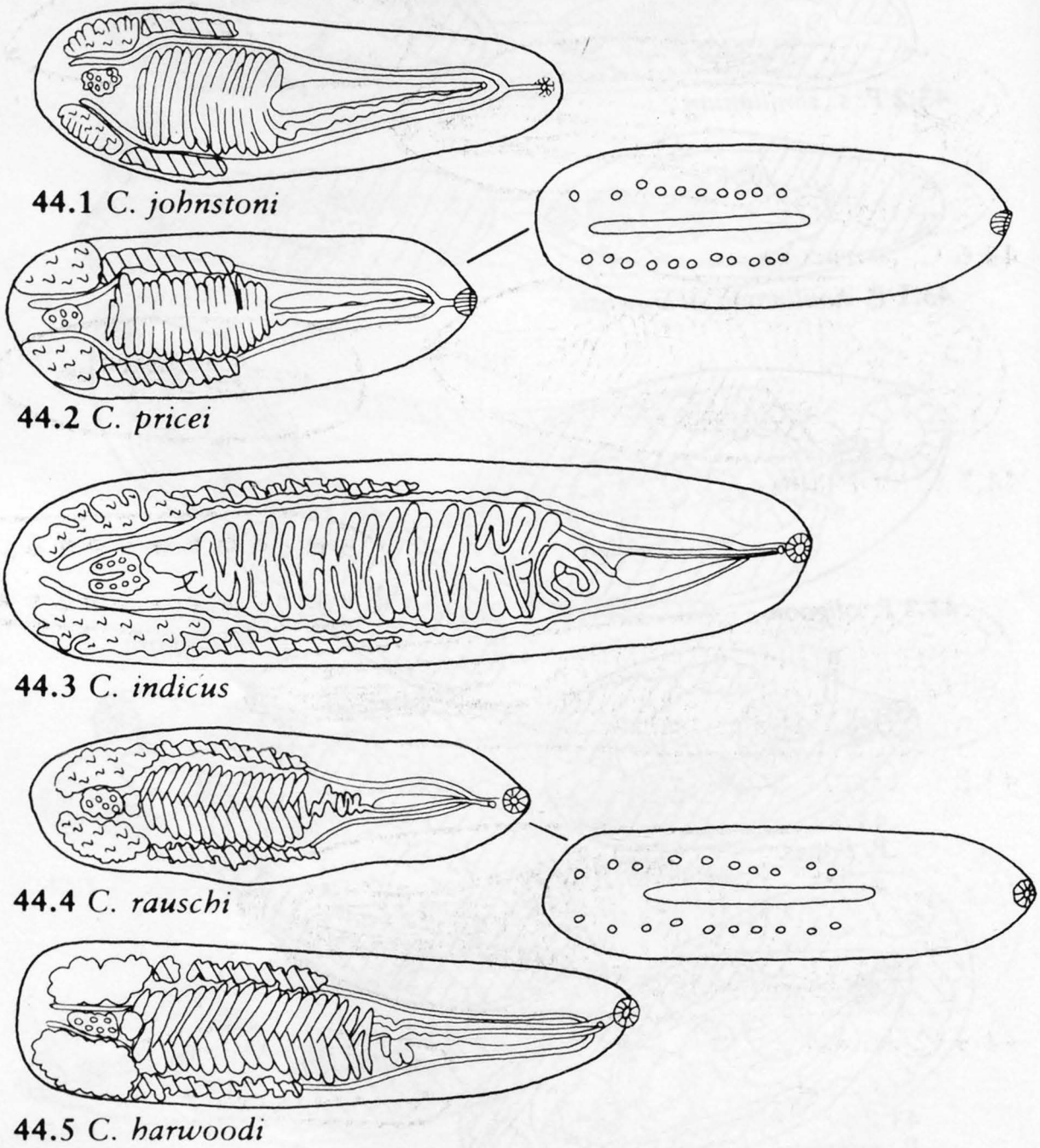


Figure 43. Genus *Psilotrema*



44.1 *C. johnstoni*

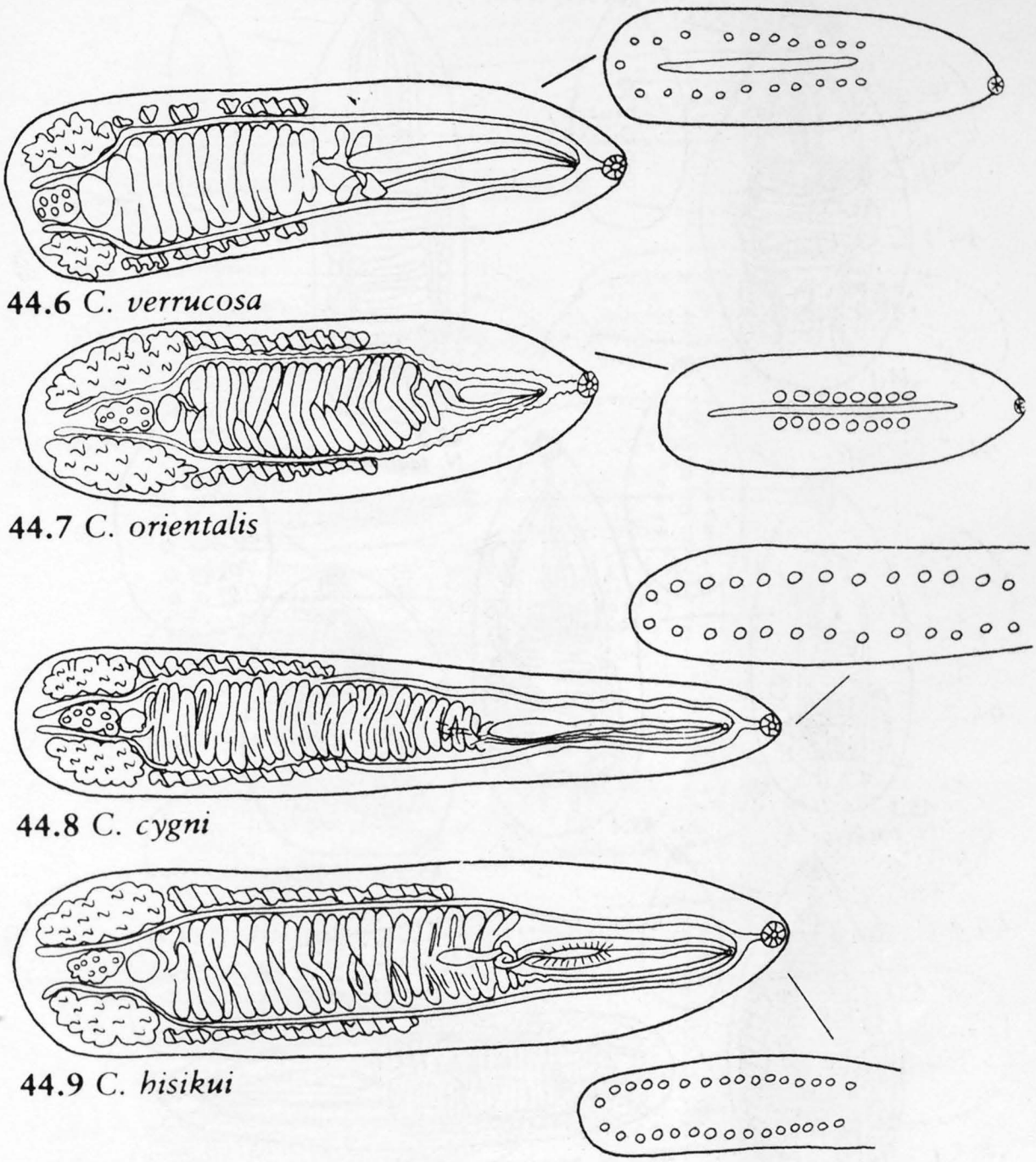
44.2 *C. pricei*

44.3 *C. indicus*

44.4 *C. rauschi*

44.5 *C. harwoodi*

Figure 44. Genus *Catatropis*



44.6 *C. verrucosa*

44.7 *C. orientalis*

44.8 *C. cygni*

44.9 *C. hisikui*

Fig. 44. Genus *Catatropis* (cont. - 2)

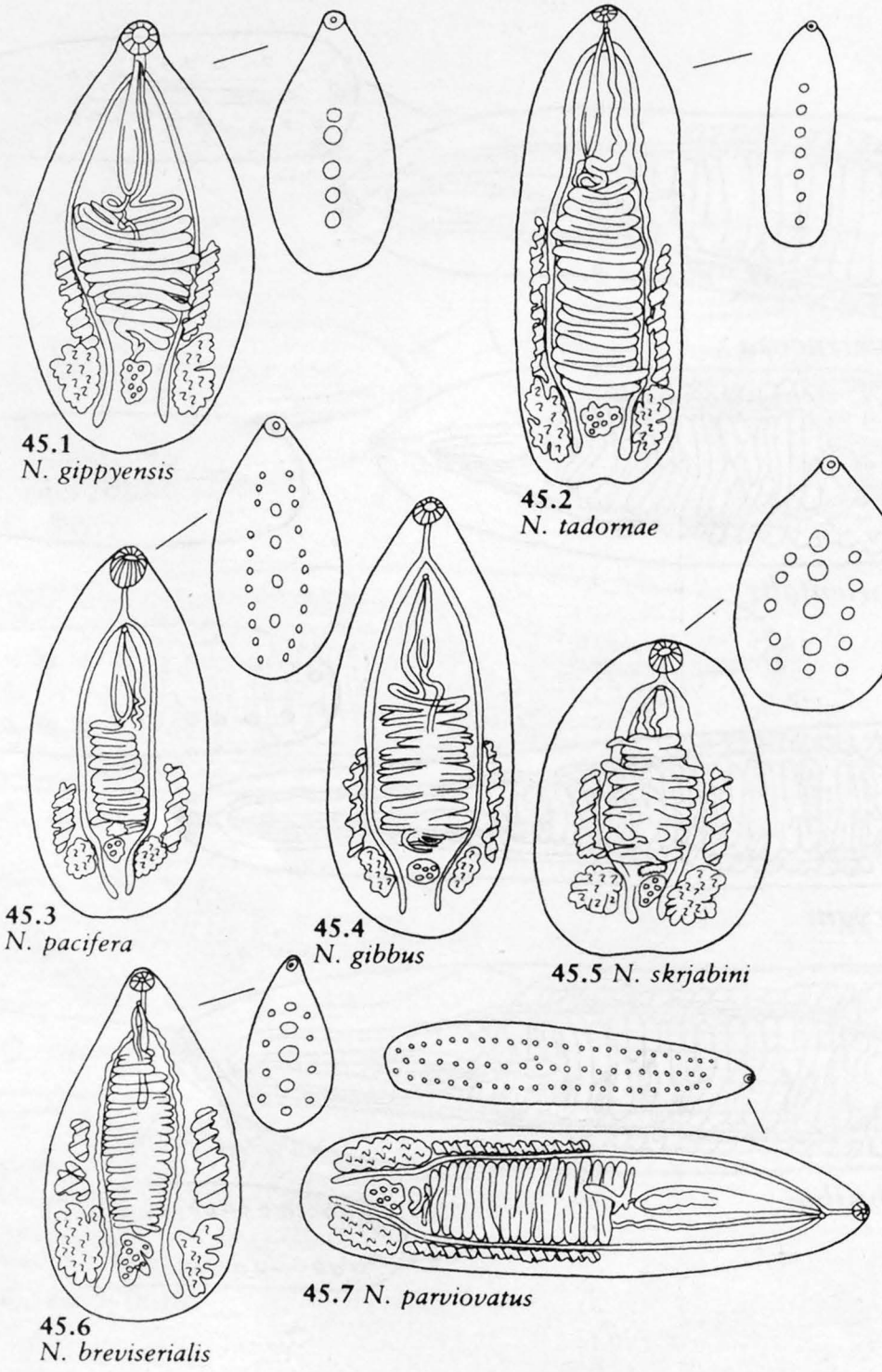


Fig. 45. Genus *Notocotylus*

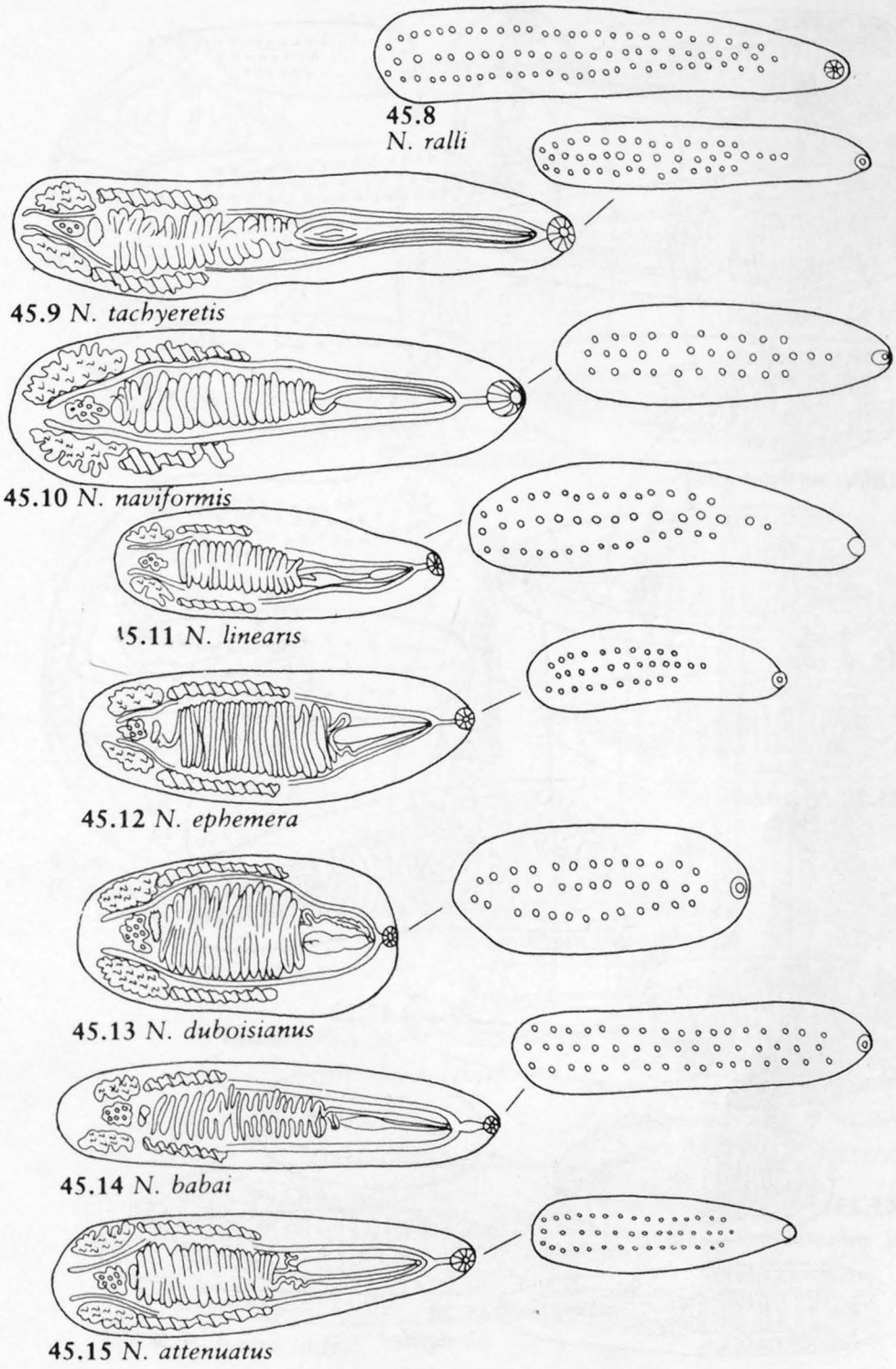


Fig. 45. Genus *Notocotylus* (cont. - 2)

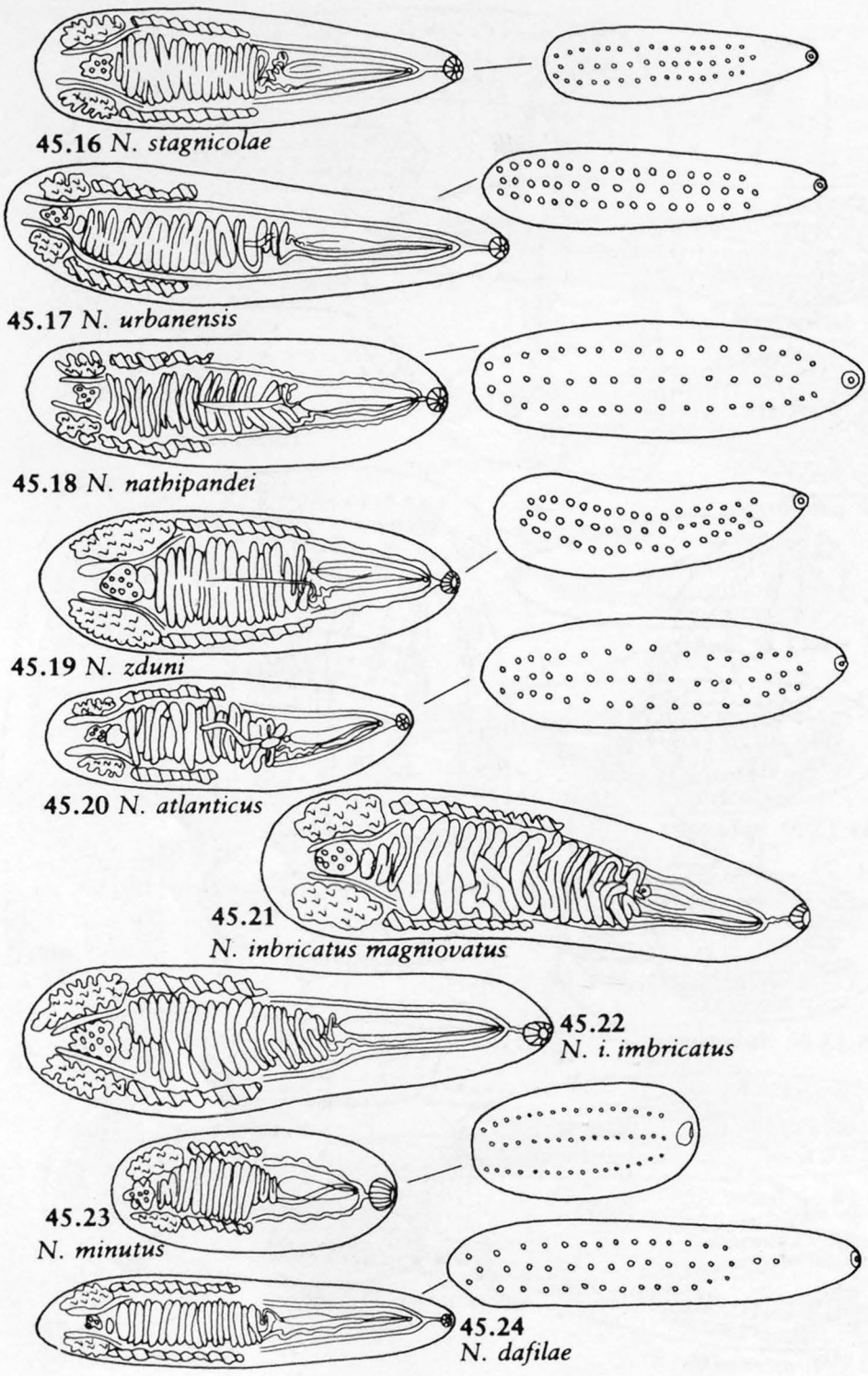
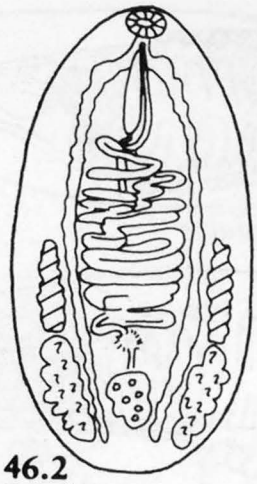


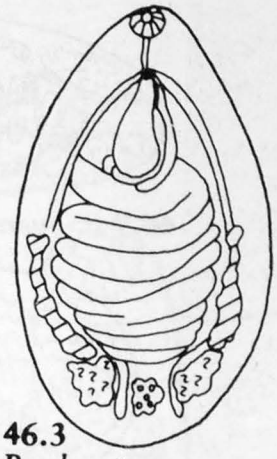
Fig. 45. Genus *Notocotylus* (cont. - 3)



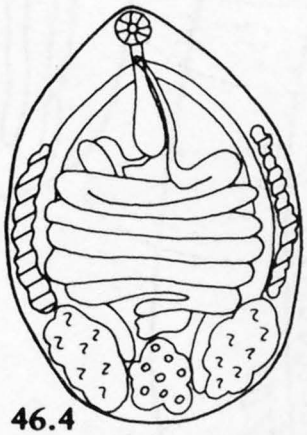
46.1
P. parvum



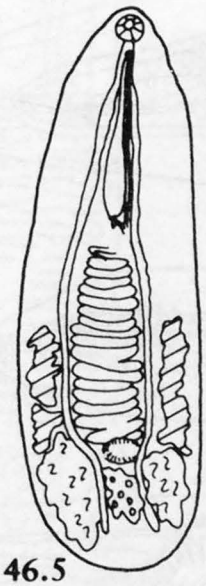
46.2
P. philippinensis



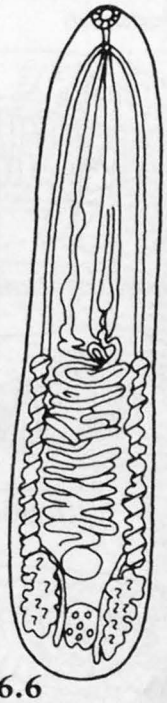
46.3
P. alveatum



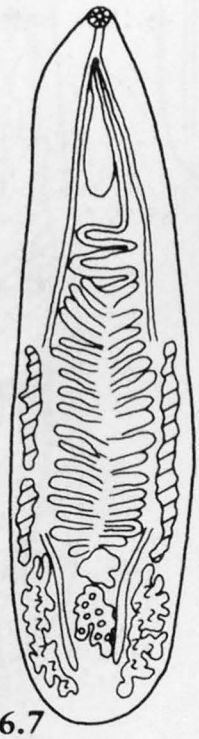
46.4
P. pseudalveatum



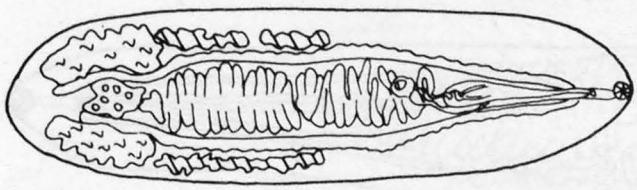
46.5
P. nettioni



46.6
P. malerischi

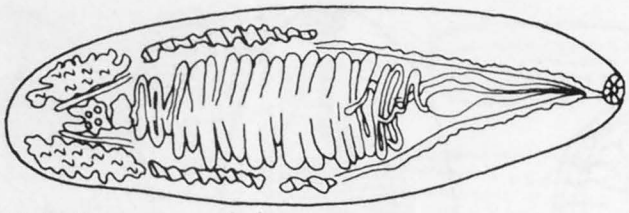


46.7
P. casarcum

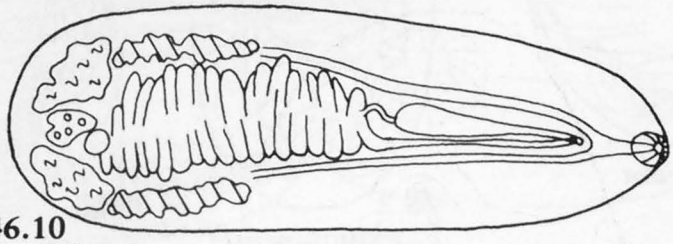


46.8 *P. harwoodi*

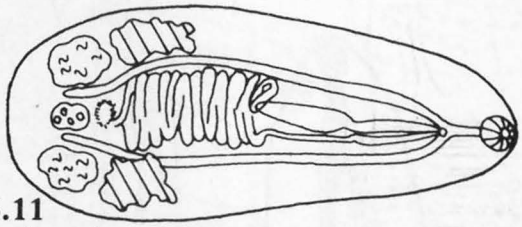
Fig. 46. Genus *Paramonostomum*



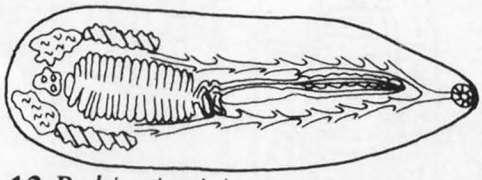
46.9 *P. querquedulae*



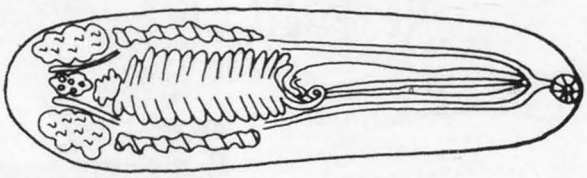
46.10
P. chabaudi



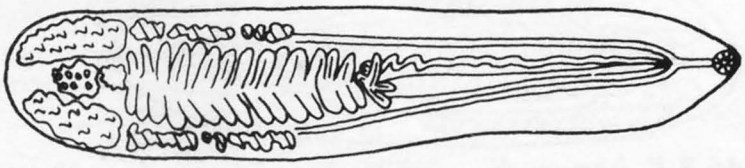
46.11
P. alveoelongatum



46.12 *P. histrionici*



46.13 *P. bucephalae*



46.14 *P. elongatum*

Fig. 46. Genus *Paramonostomum* (cont. - 2)

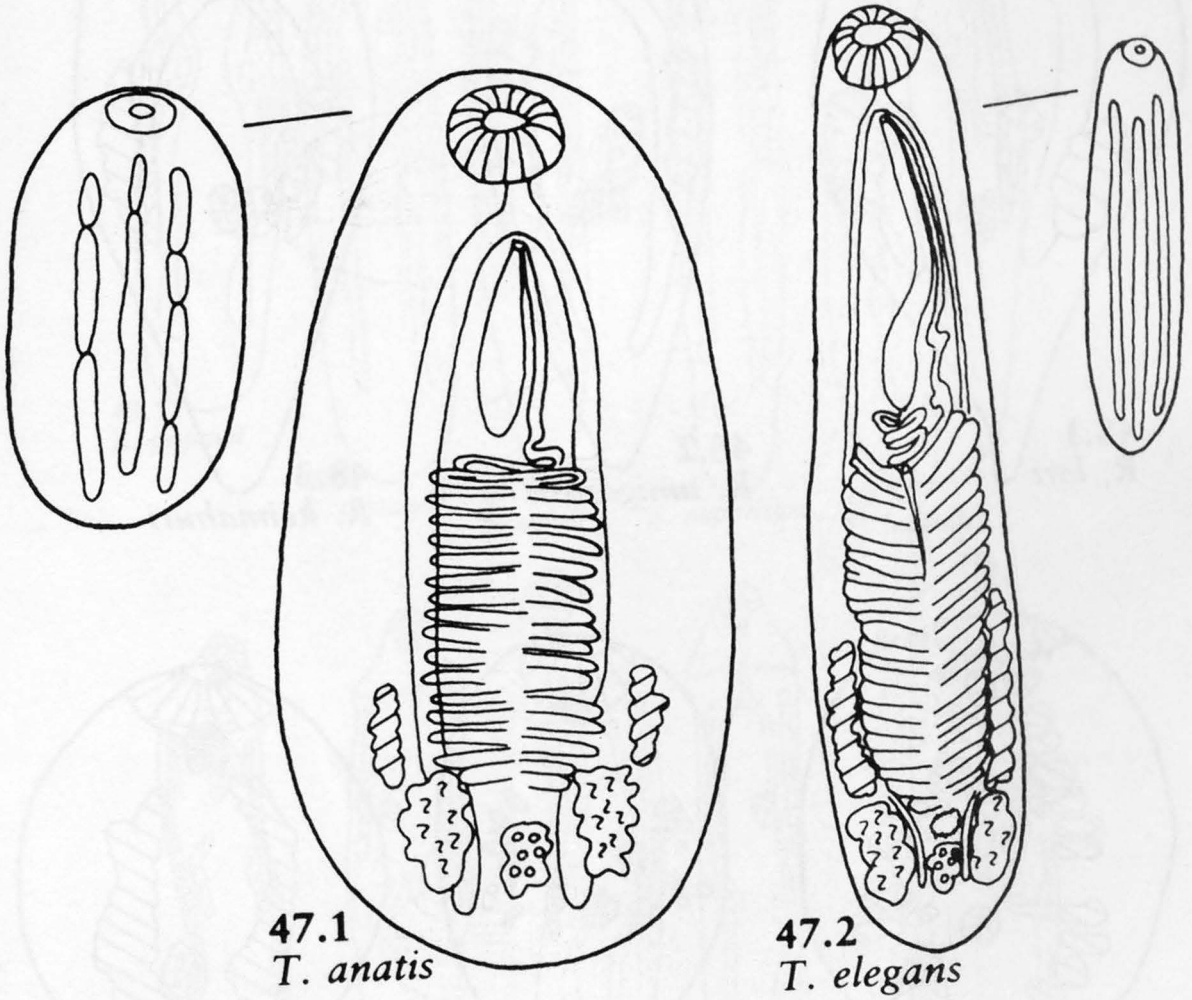
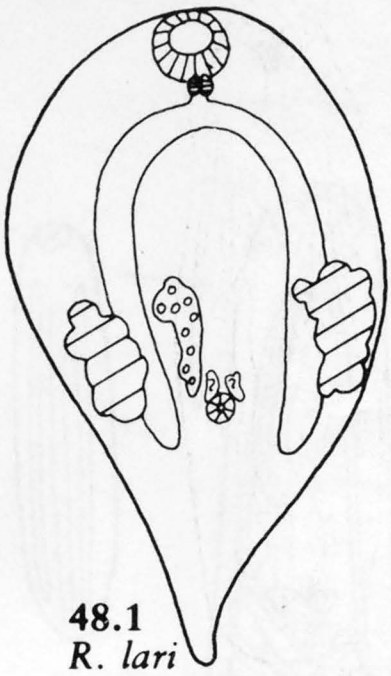
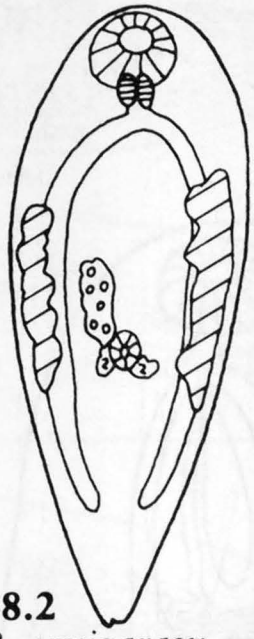


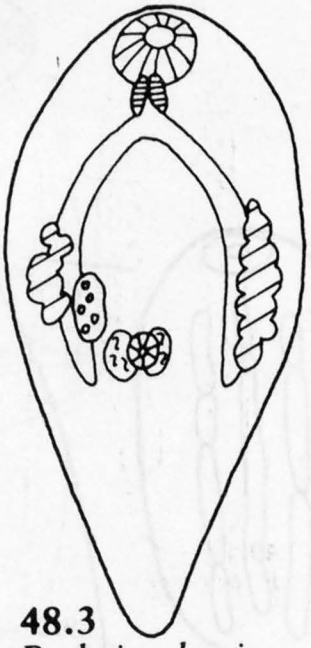
Fig. 47. Genus *Tristriata*



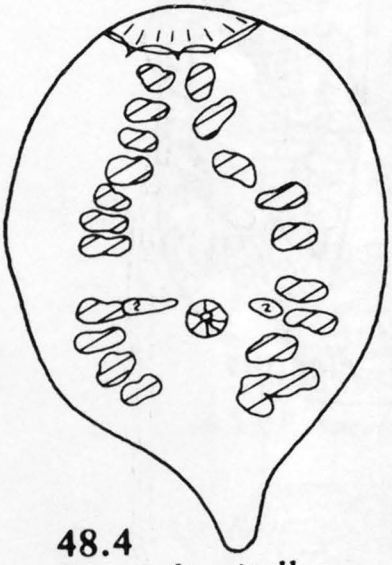
48.1
R. lari



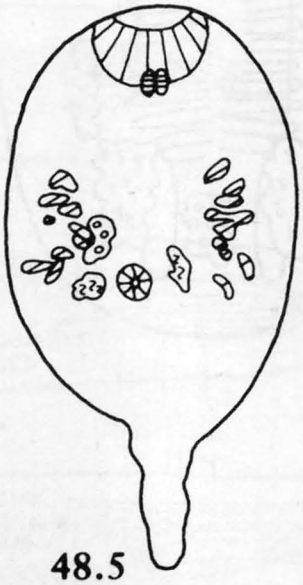
48.2
R. umigarasu



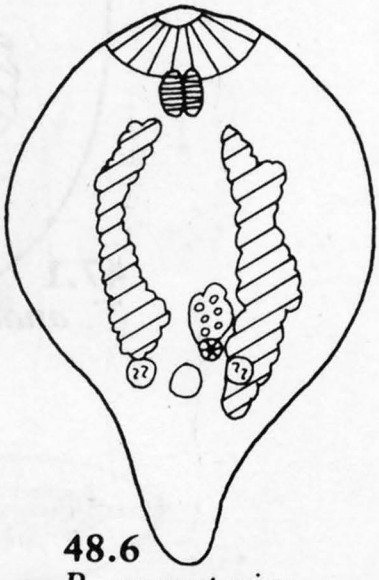
48.3
R. keimahuri



48.4
R. mediovitellata



48.5
R. mollissima



48.6
R. somateriae

Fig. 48. Genus *Renicola*

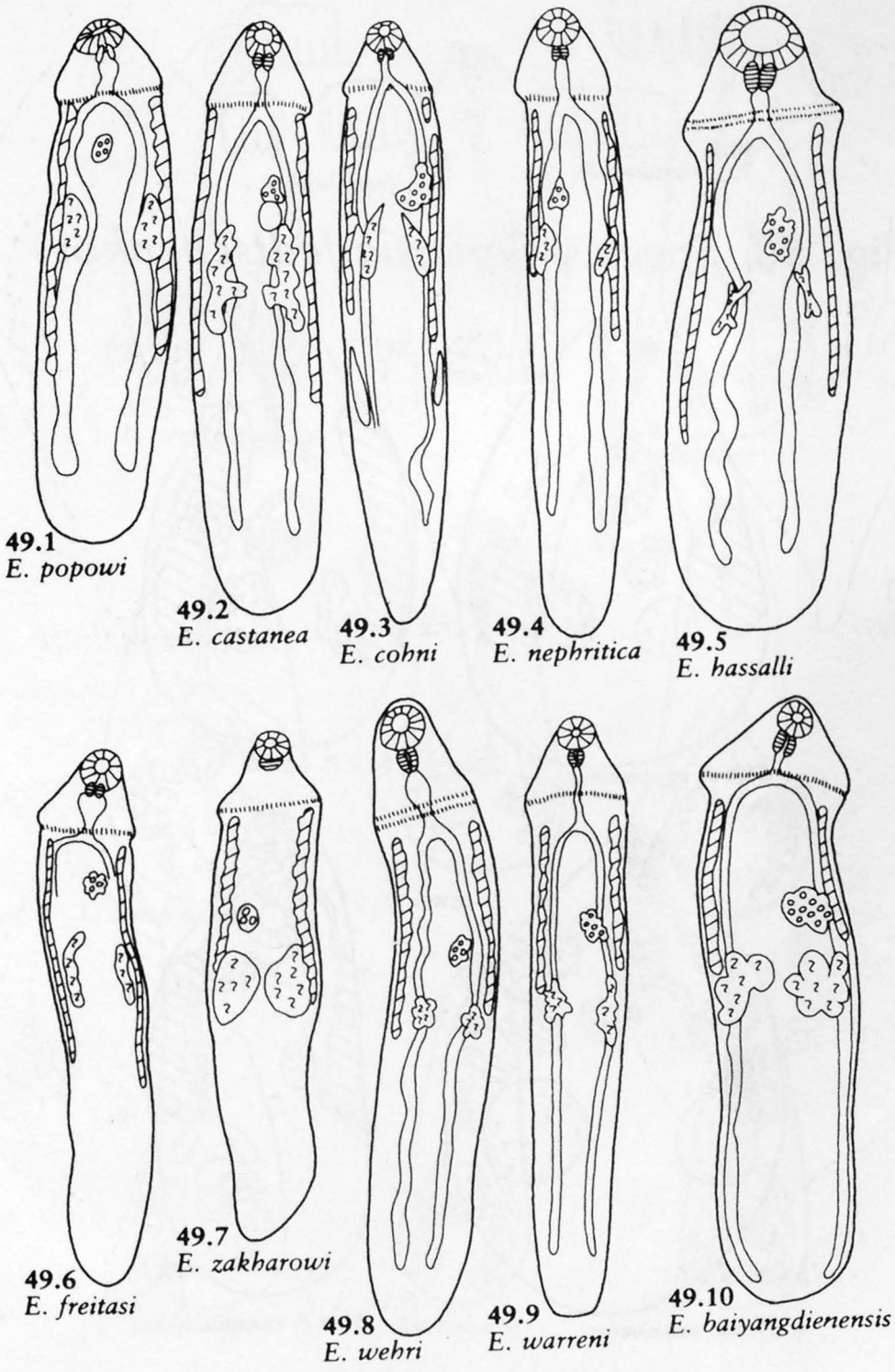
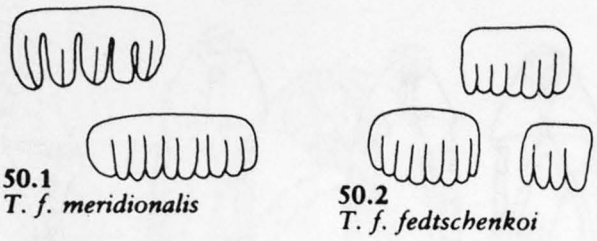


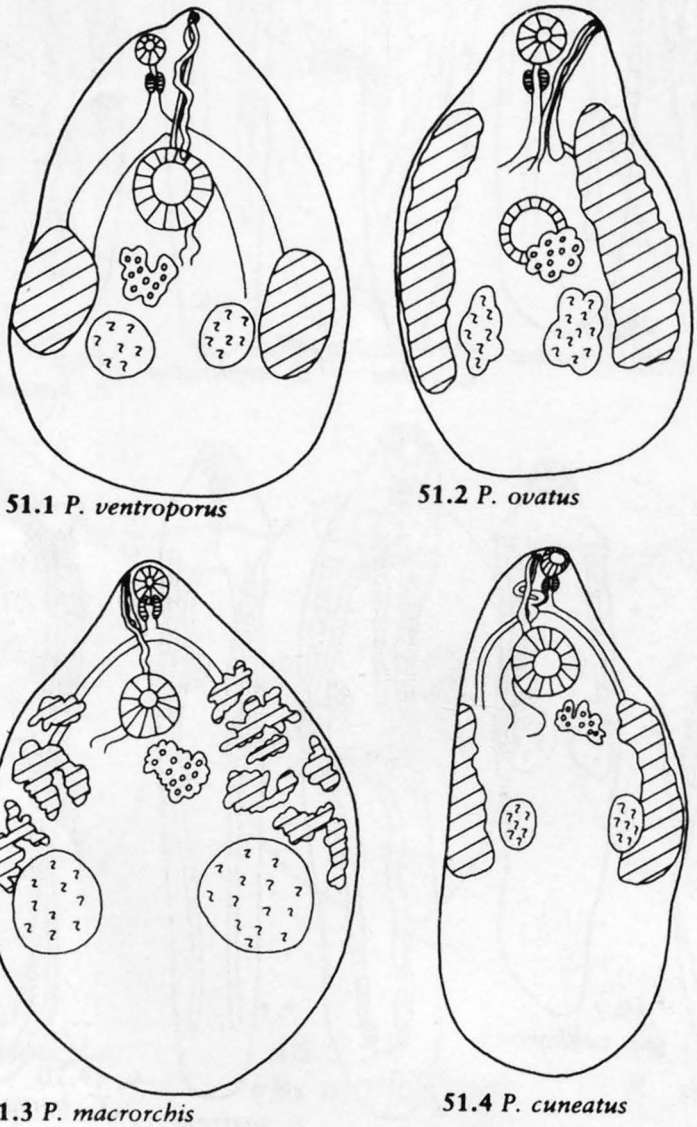
Fig. 49. Genus *Eucotyle*



50.1
T. f. meridionalis

50.2
T. f. fedtschenkoi

Fig. 50. Species *Tanaisia fedtschenkoi*



51.1 *P. ventroporus*

51.2 *P. ovatus*

51.3 *P. macrorchis*

51.4 *P. cuneatus*

Fig. 51. Genus *Prosthogonimus*

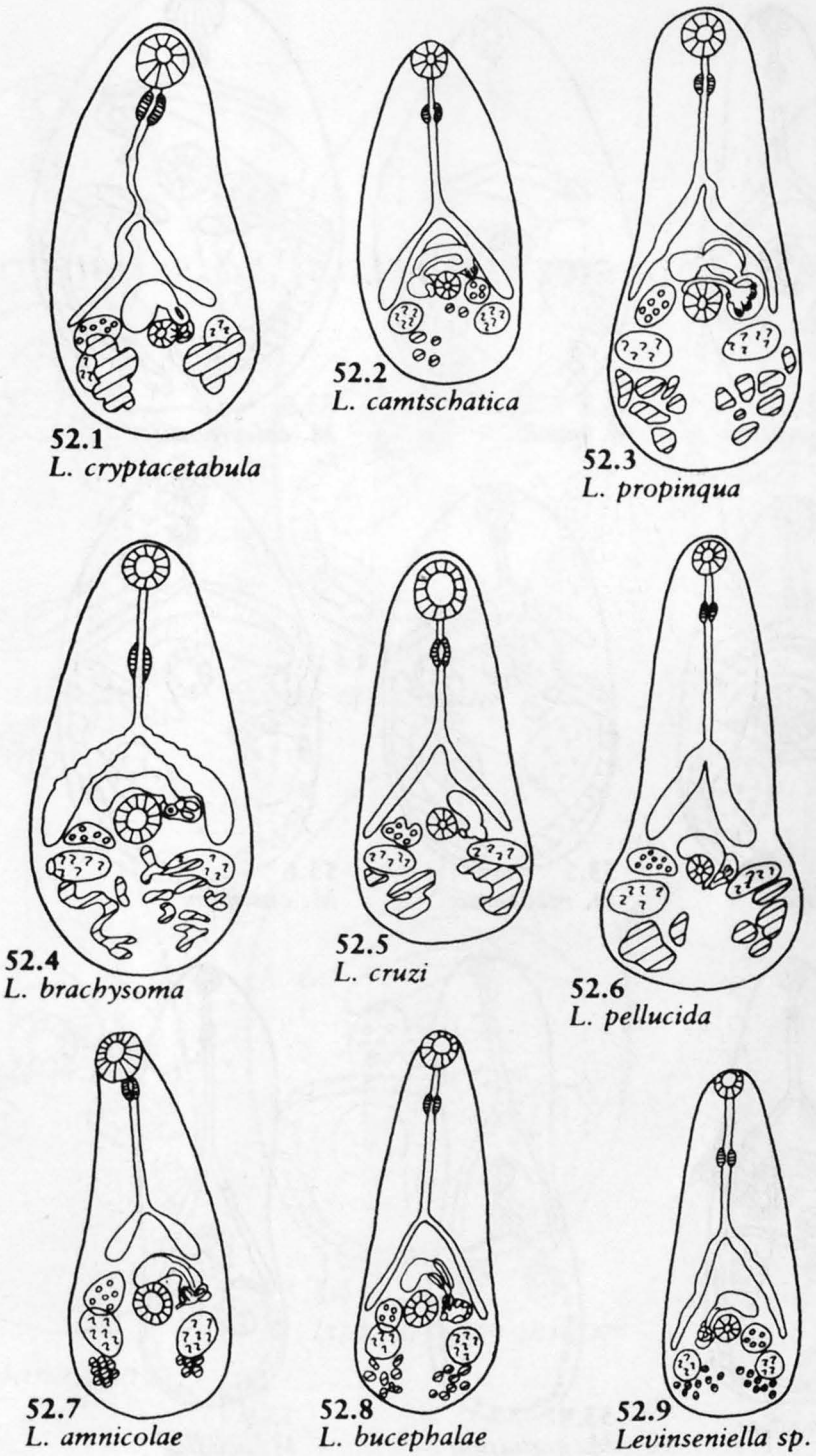


Fig. 52. Genus *Levinseniella*

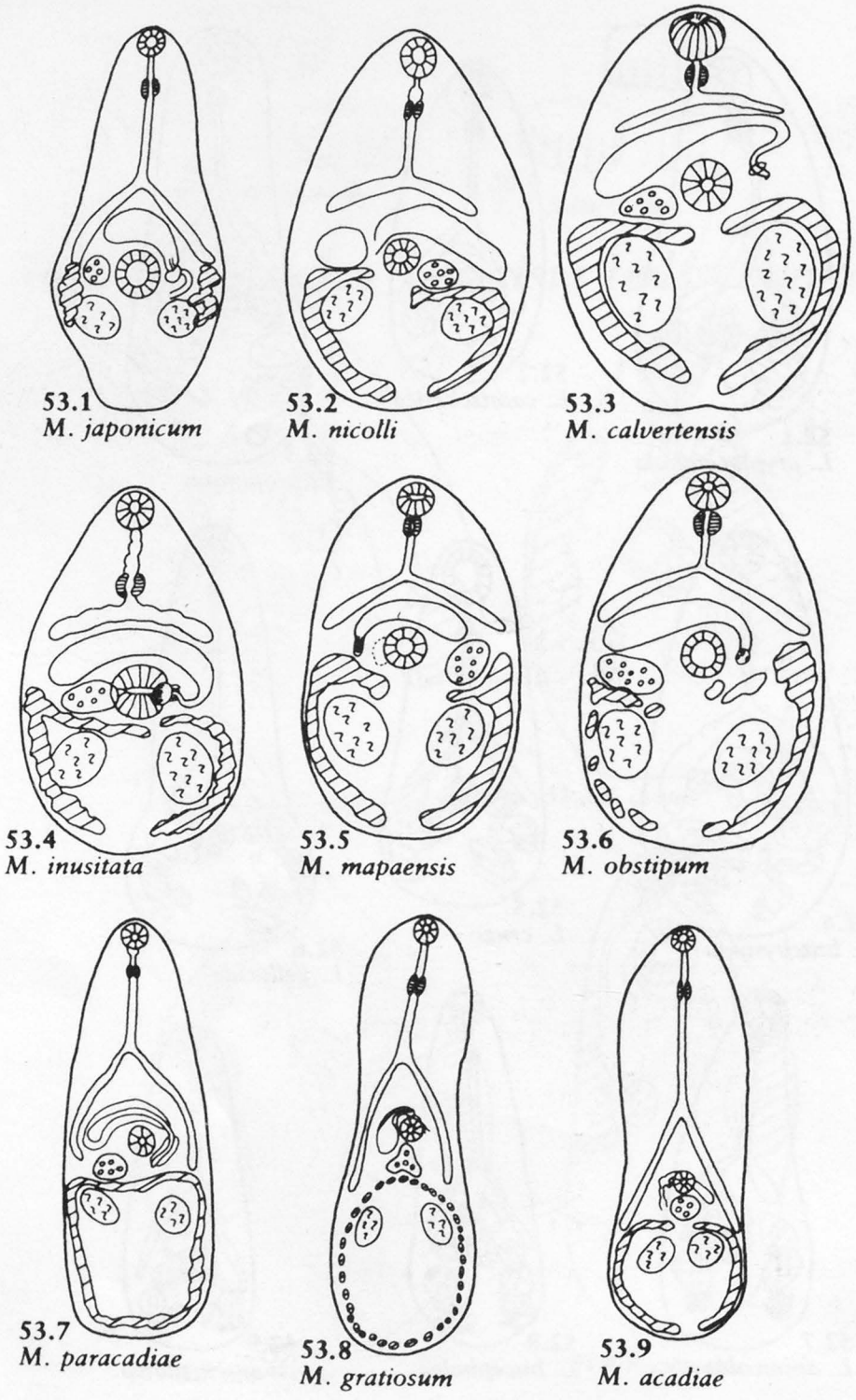
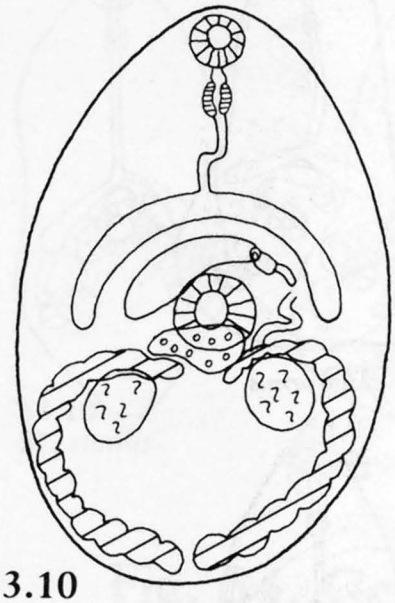
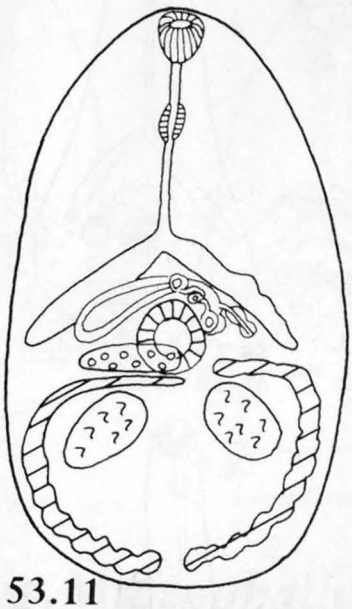


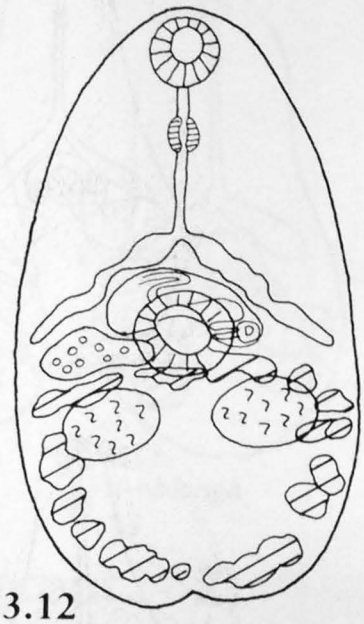
Fig. 53. Genus *Maritrema*



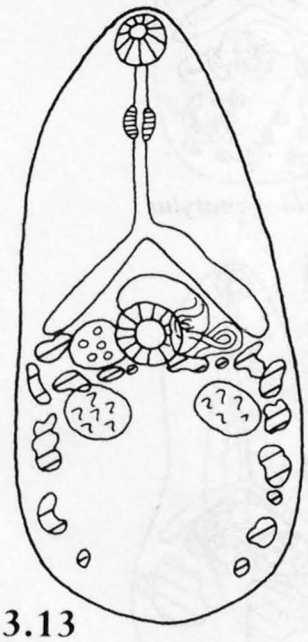
53.10
M. macracetabulum



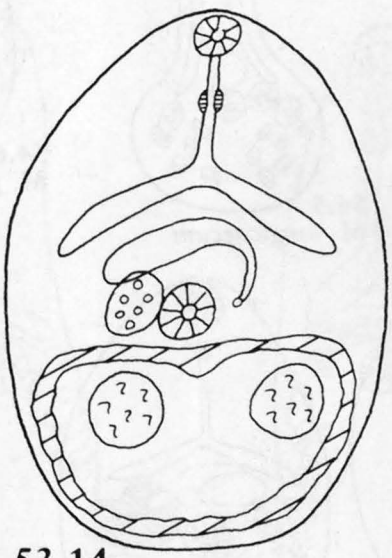
53.11
M. subdolum



53.12
M. megametrios



53.13
M. a. afanassjewi



53.14
M. afanassjewi minor

Fig. 53. Genus *Maritrema* (cont. - 2)

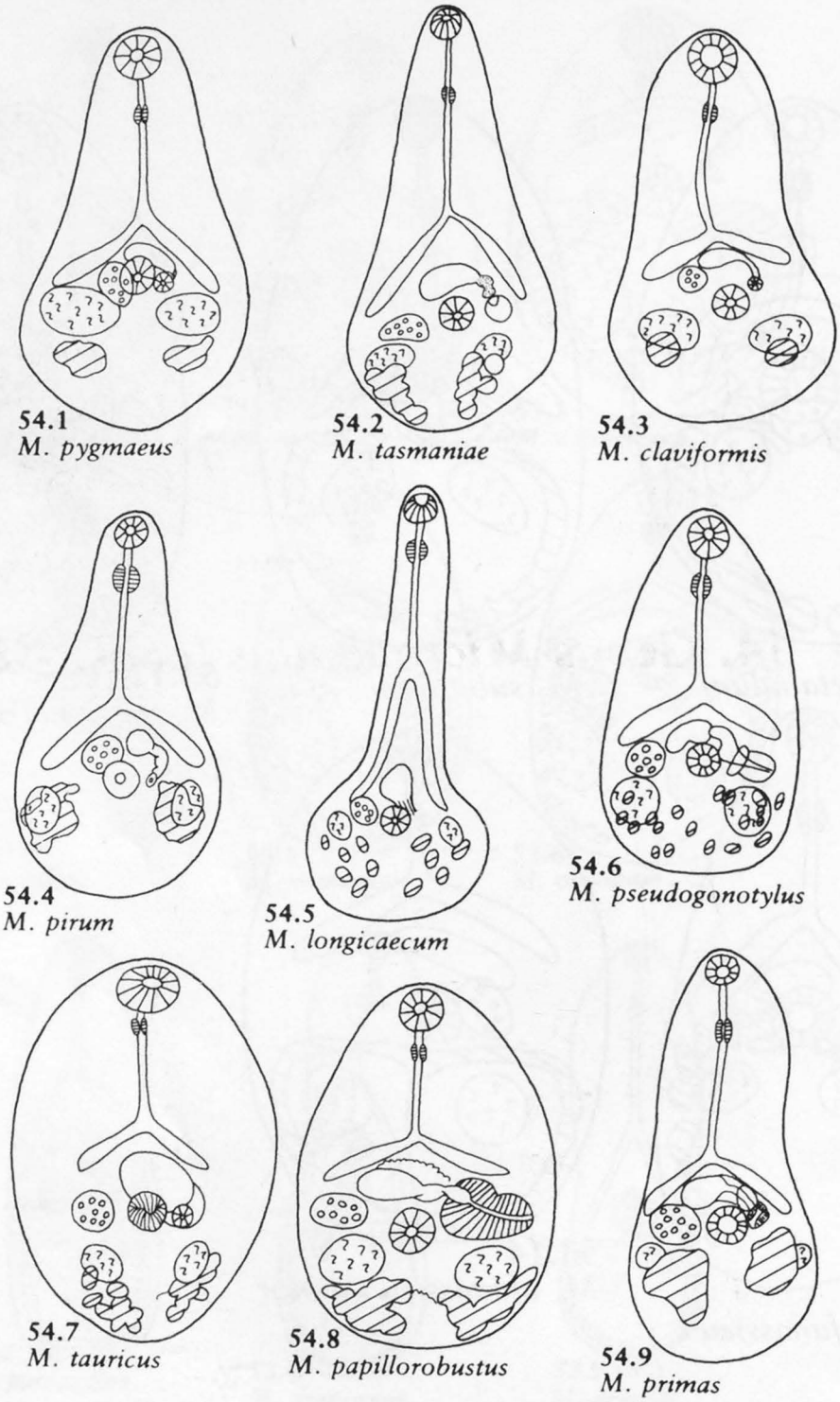
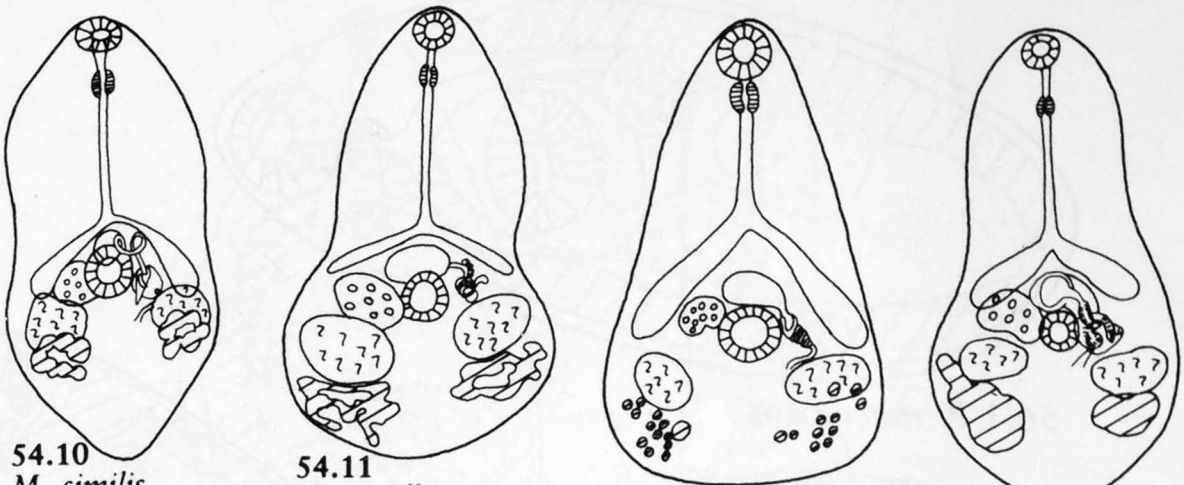


Fig. 54. Genus *Microphallus*



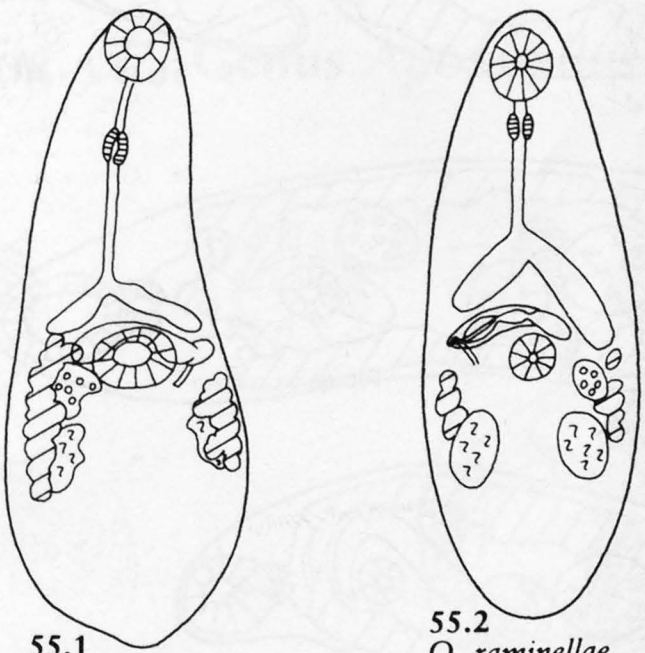
54.10
M. similis

54.11
M. nicolli

54.12
M. somateriae

54.13
M. oblonga

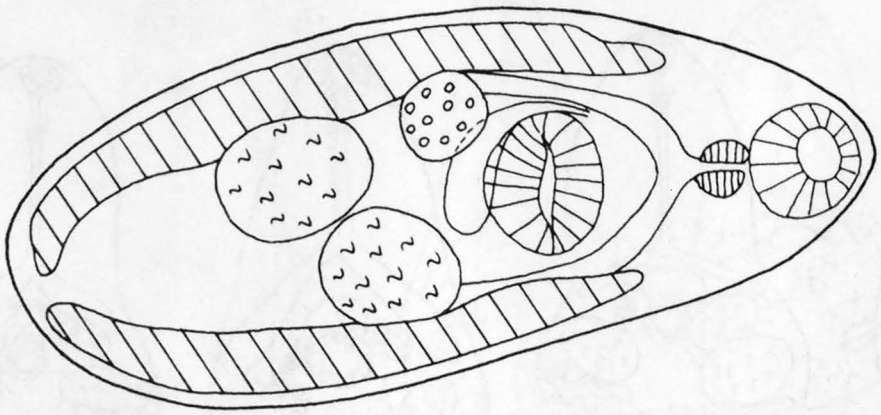
Fig. 54. Genus *Microphallus* (cont. - 2)



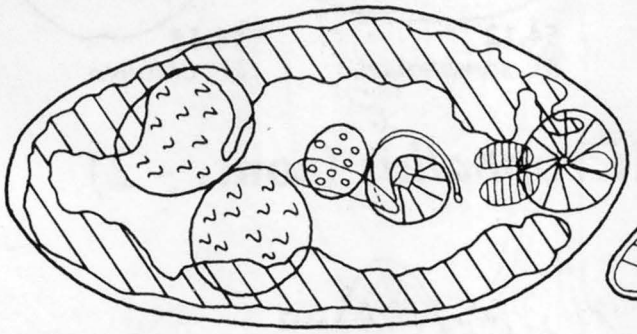
55.1
O. odhneri

55.2
O. raminellae

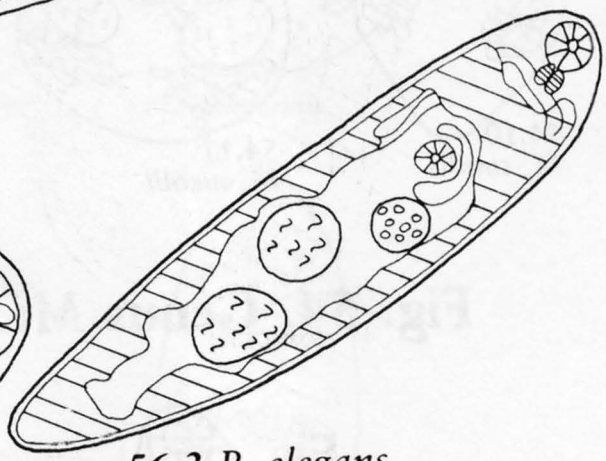
Fig. 55. Genus *Odhneria*



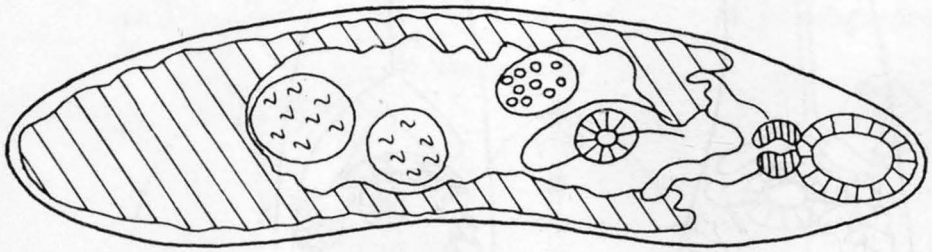
56.1 *P. maculosus*



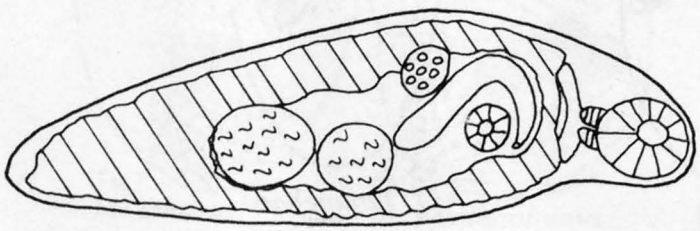
56.2 *P. nyrocae*



56.3 *P. elegans*

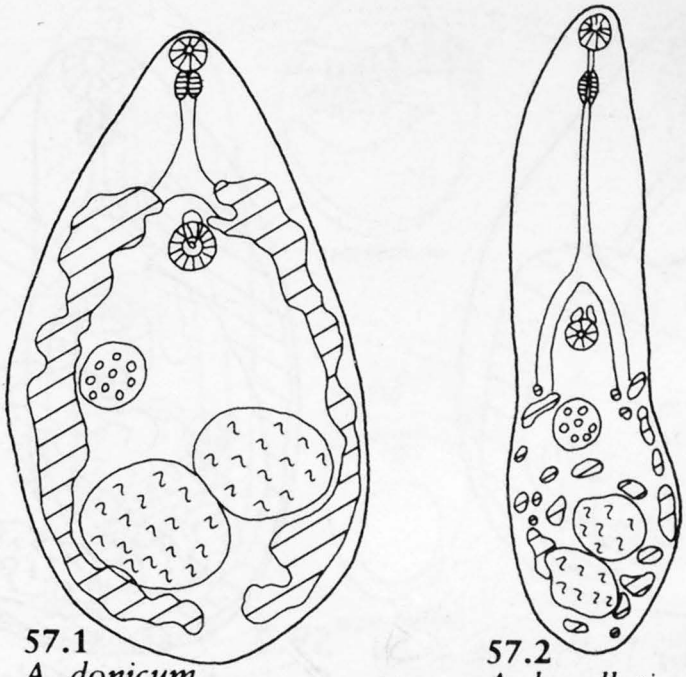


56.4 *P. nanus*



56.5 *P. fastuosus*

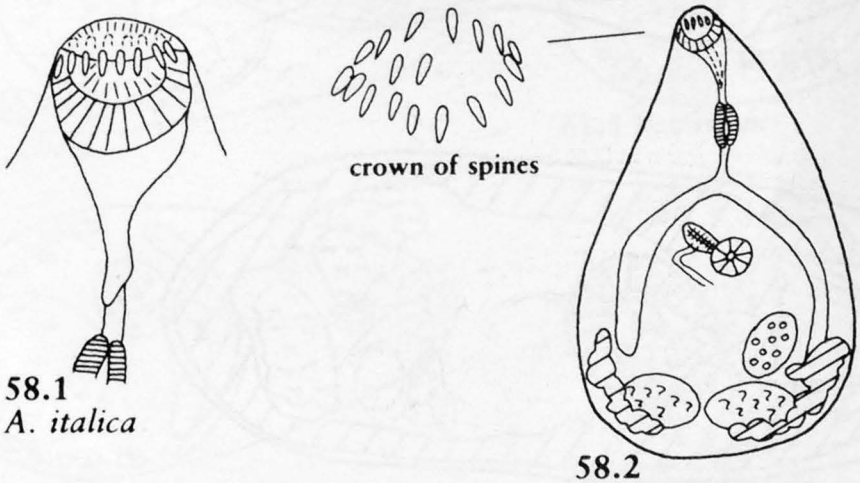
Fig. 56. Genus *Plagiorchis*



57.1
A. donicum

57.2
A. bacalloti

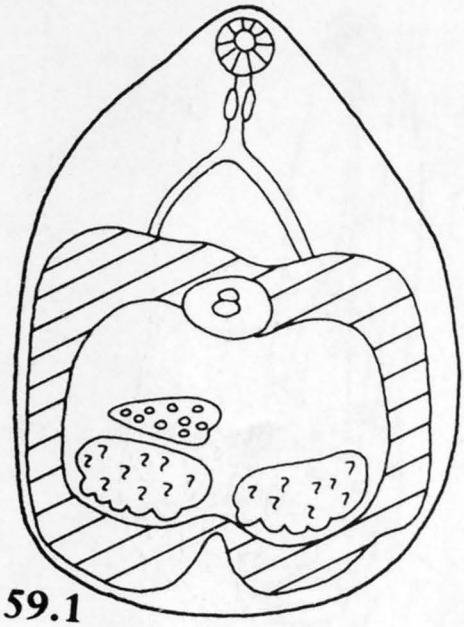
Fig. 57. Genus *Apophallus*



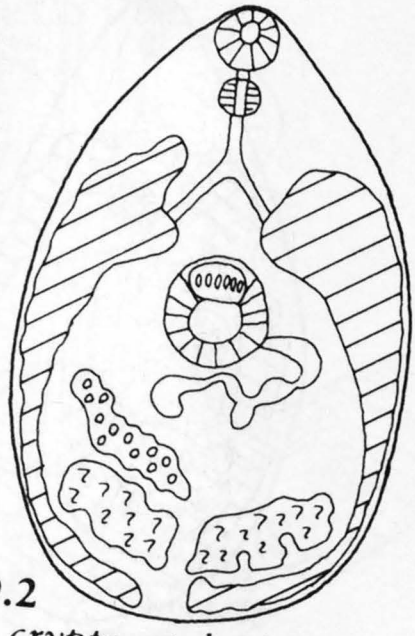
58.1
A. italica

58.2
A. angrense

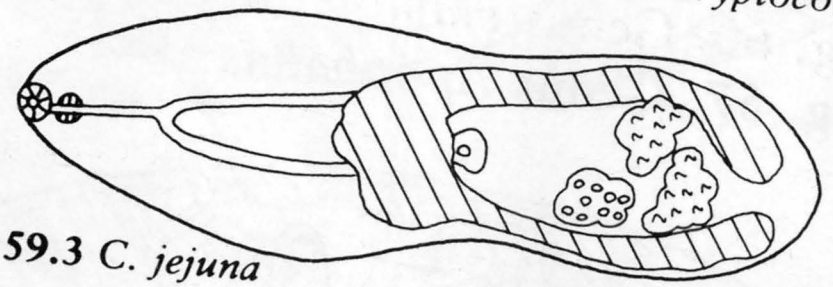
Fig. 58. Genus *Ascocotyle*



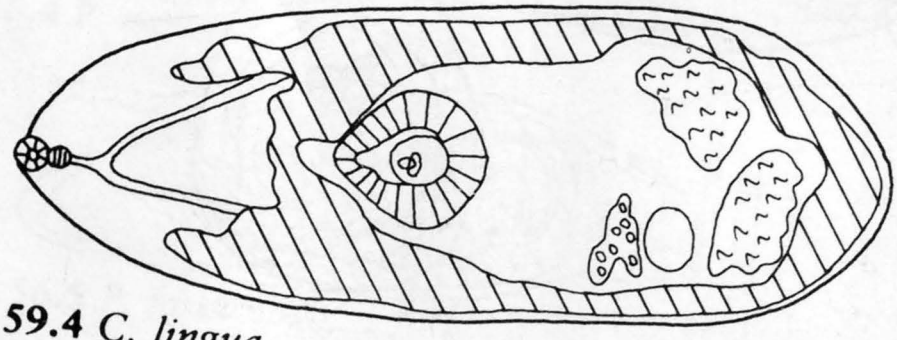
59.1
C. concavum



59.2
C. cryptocotyloides

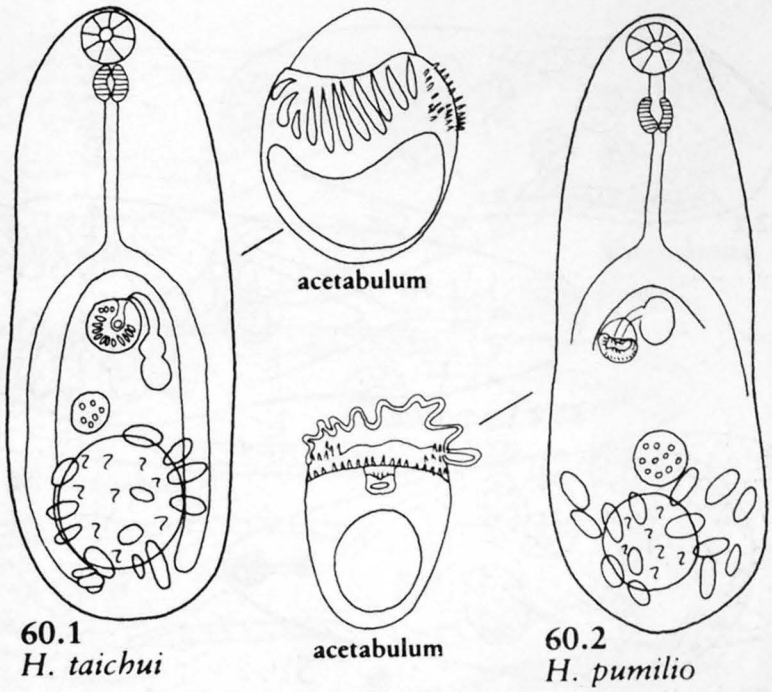


59.3 *C. jejuna*



59.4 *C. lingua*

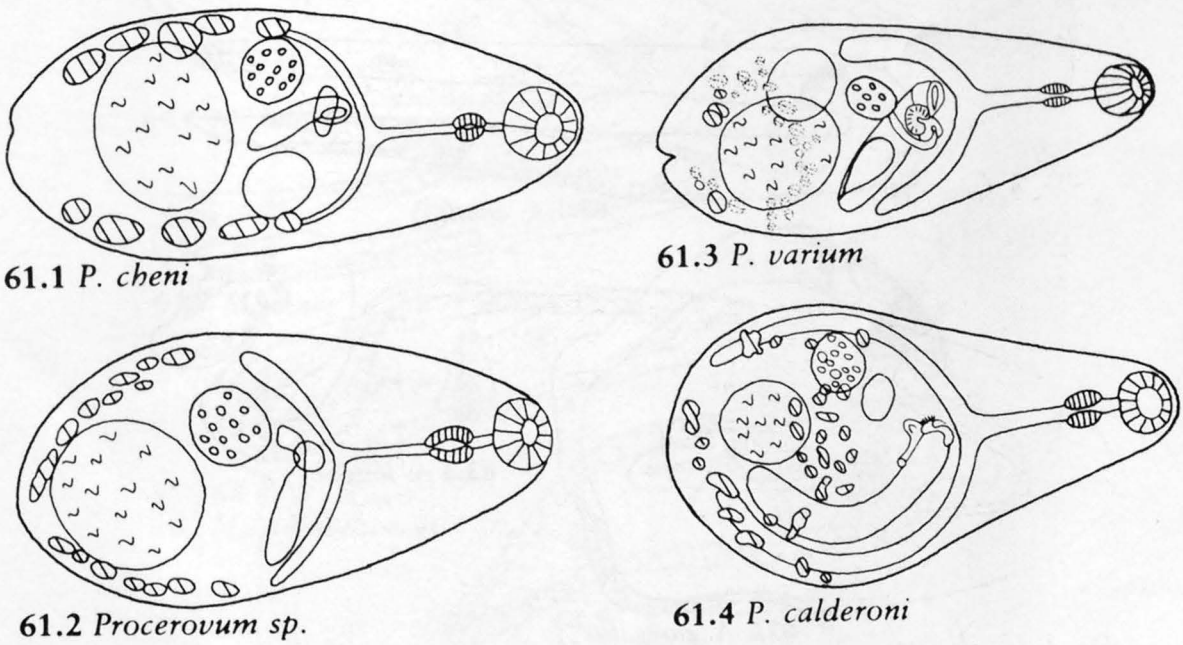
Fig. 59. Genus *Cryptocotyle*



60.1
H. taichui

60.2
H. pumilio

Fig. 60. Genus *Haplorchis*



61.1 *P. cheni*

61.3 *P. varium*

61.2 *Procerovum sp.*

61.4 *P. calderoni*

Fig. 61. Genus *Procerovum*

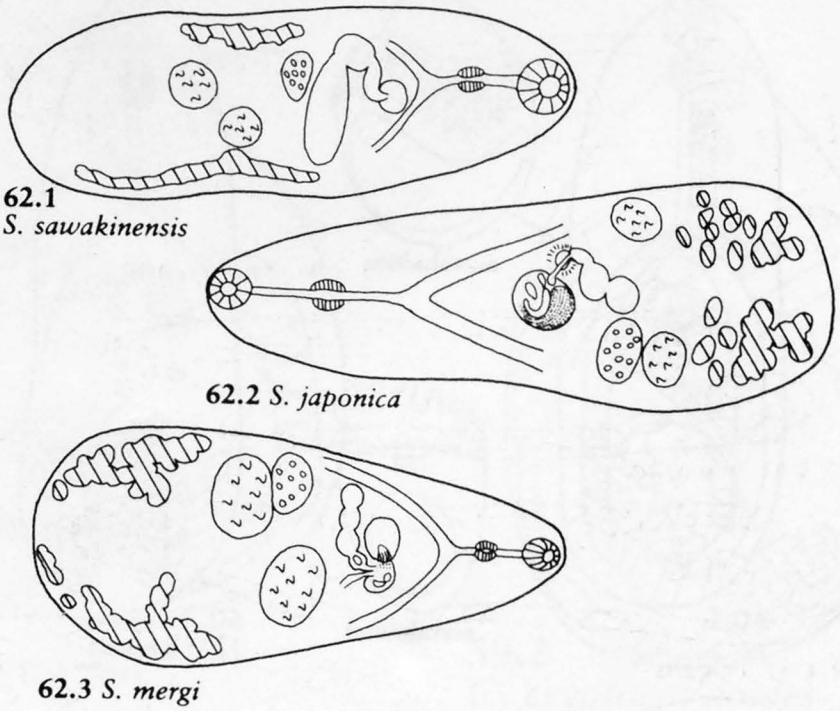


Fig. 62. Genus *Stictodora*

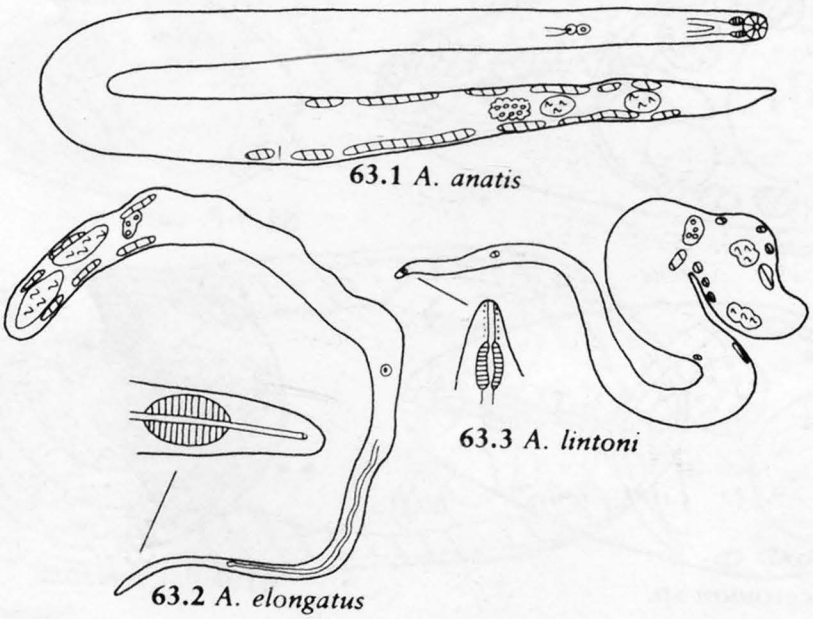


Fig. 63. Genus *Amphimerus*

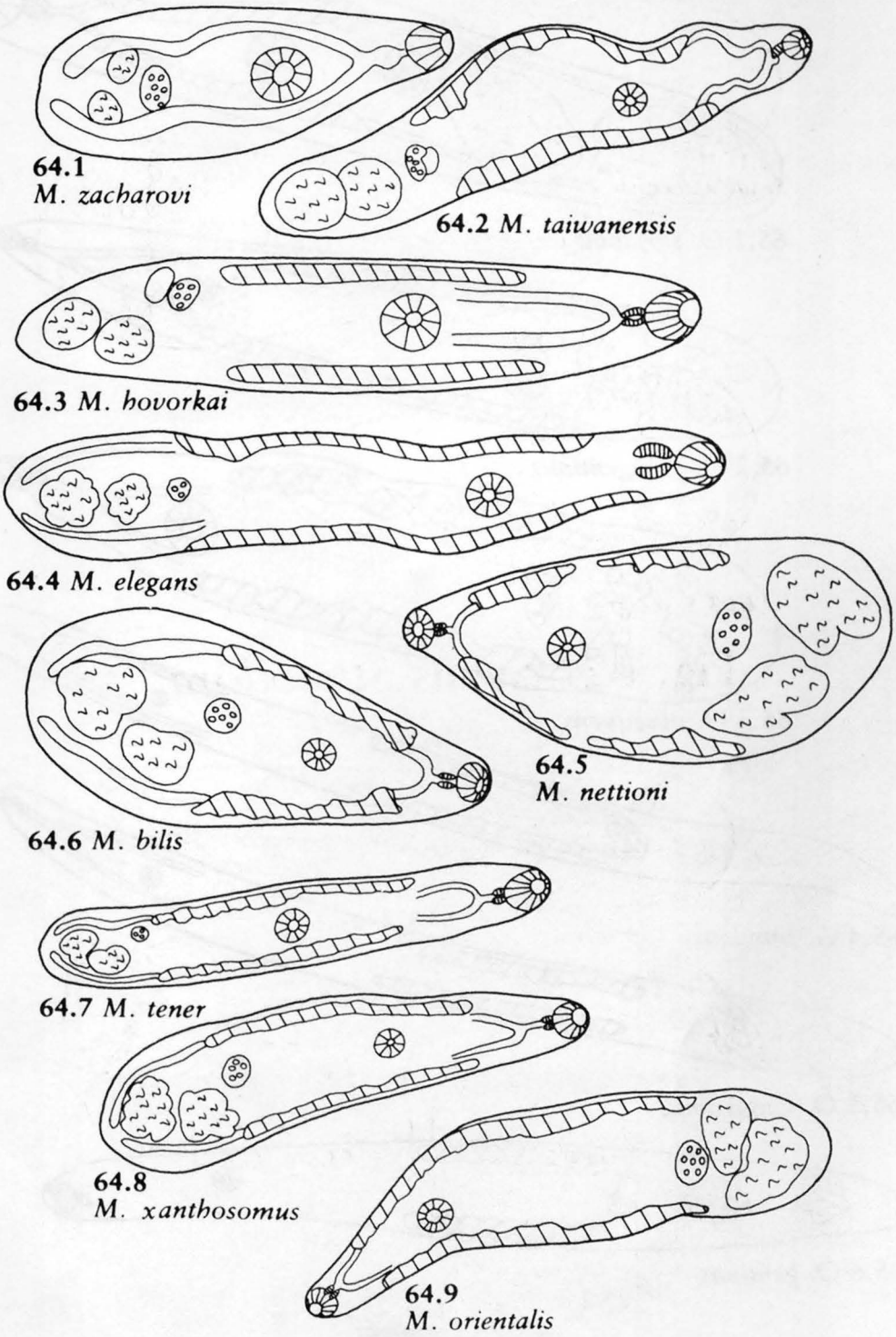
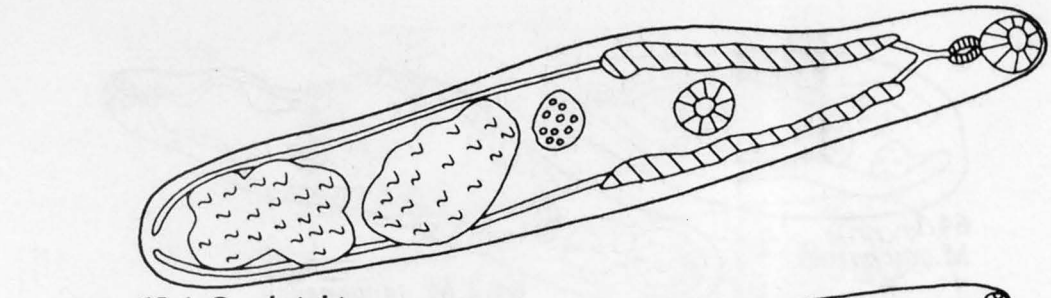
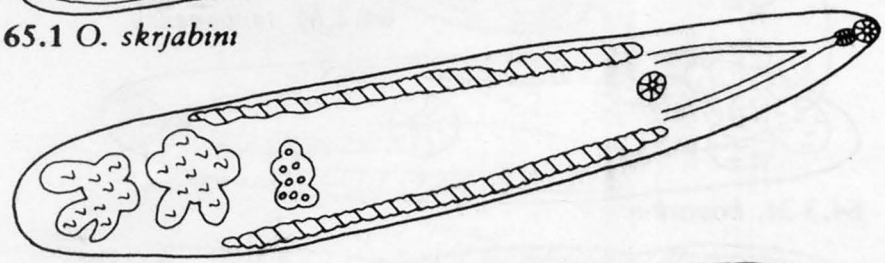


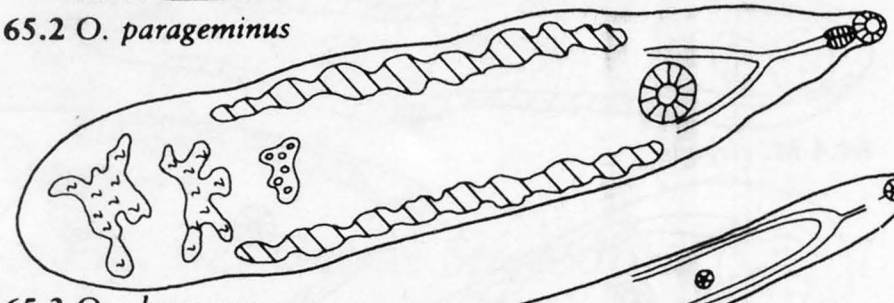
Fig. 64. Genus *Metorchis*



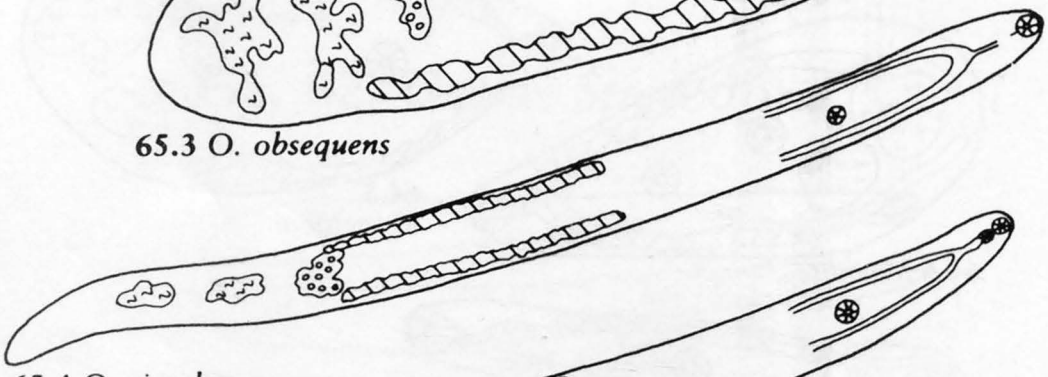
65.1 *O. skrjabini*



65.2 *O. parageminus*

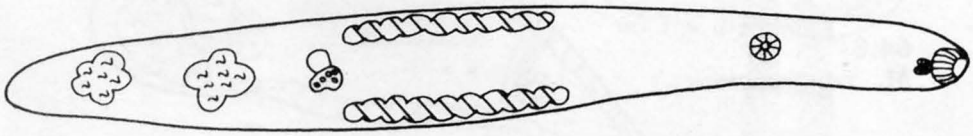


65.3 *O. obsequens*



65.4 *O. simulans*

65.5 *O. longissimus*



65.6 *O. geminus*

Fig. 65. Genus *Opisthorchis*

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