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STUDIES ON MYXOSPORIDIA

A SYNOPSIS OF GENERA AND SPECIES OF MYXOSPORIDIA

WITH 25 PLATES AND 2 TEXTFIGURES

BY

ROKUSABURO KUDO

Contributions from the
Zoological Laboratory of the University of Illinois
No. 158

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INTRODUCTION

Ten years have elapsed since Auerbach (1910) published *Die Cnidosporidien* in which he gave a synopsis of the genera and species of Myxosporidia known up to that time. During this period new genera and a number of new species have been added to the list of this particular group of parasitic protozoa from the various parts of the world. It is, therefore, desirable to have a complete monographic work including all the forms reported up to the present time.

The main objects of the present paper are: 1) to describe a new genus and a number of new species which have come under the observation of the writer; 2) to collect all the genera and species recorded by various authors; 3) to propose a new classification by which some of the confusion now existing may, probably, be avoided; 4) to show the geographical, zoological and organal distribution in the light of more recent observations; and 5) to present a complete list of the names of the hosts in which Myxosporidia occur.

The writer believes himself to be in possession of as complete references as possible under present conditions. However, he may be unaware of some works which have not reached him owing to the war.

The Myxosporidia recorded by Labbé (1899) are arranged in almost the same order as that author listed them, with some slight change such as placing the type species at the front of each genus or removing a few species to other genera, while those species which have been described since 1898 are arranged chronologically, no matter whether names are given the species or not.

Some of the references are omitted, especially when they can be found in Gurley (1894), Thélohan (1895), Labbé (1899), or Auerbach (1910). The description of each species is given according to the first observer. The observations of subsequent investigators are then mentioned in the second place.

Each species is described according to the following scheme:

1) Specific name
2) Synonyms and literature
3) Habitat, including the locality and the date of observation
4) Vegetative form
5) Spore
6) Remarks

I wish to express my appreciation to Professor Henry B. Ward whose kindness has made the completion of this paper possible.

GENERAL REMARKS ON RECENT OBSERVATIONS

The total number of species of Myxosporidia reported up to date and described in the following pages, excluding 12 ambiguous forms, reaches 237 of which 125 are species which have been observed since 1910.*

The distribution of these new forms is as follows:

Africa	6 species
Asia	23 species
Australia	1 species
Europe	31 species
North America	63 species
South America	1 species

Thus, the majority of the species were observed in other lands than Europe, nearly half being recorded from North American waters. It is not hard to anticipate from the observations made by Awerinzew, Davis, Kudo, Mavor, Johnston and Bancroft, and others, that further investigations on the parasites in the localities where the study of the protozoa under consideration was neglected, will bring out not only new and interesting forms which will be quite different from the comparatively well studied European species, but also many important facts that will clear unknown or doubtful phases concerning the life history and structure of Myxosporidia.

* Three species are included here which have been described (in Nipponese) by Miyairi in 1909.

MYXOSPORIDIA RECORDED IN THE PRESENT PAPER

LIST I

Order MYXOSPORIDIA Bütschli

I Suborder EURYSPOREA nom. nov. (see page 56)

I Family CERATOMYXIDAE Doflein

Genus 1 LEPTOTHECA Thélohan [15 species]

1) *L. agilis* Thélohan (type species)
2) *L. elongata* Thélohan
3) *L. polymorpha* (Thél.) Labbé
4) *L. parva* Thélohan
5) *L. renicola* Thélohan
6) *L. hepseti* Thélohan
7) *L. perlata* (Gurley) Labbé
8) *L.* sp. Awerinzew
9) *L. macrospora* Auerbach
10) *L. informis* Auerbach
11) *L. longipes* Auerbach
12) *L. fusiformis* Davis
13) *L. scissura* Davis
14) *L. lobosa* Davis
15) *L. glomerosa* Davis

Genus 2 CERATOMYXA Thélohan [35 species]

1) *C. arcuata* Thélohan (type species)
2) *C. sphaerulosa* Thélohan
3) *C. pallida* Thélohan
4) *C. globurifera* Thélohan
5) *C. appendiculata* Thélohan
6) *C. truncata* Thélohan
7) *C. reticularis* Thélohan
8) *C. inaequalis* Doflein
9) *C. linospora* Doflein
10) *C. ramosa* Awerinzew
11) *C. drepanopsettae* Awerinzew
12) *C. tylosuri* Awerinzew
13) *C.* (?) *spari* Awerinzew
14) *C.* sp. (?) Awerinzew
15) *C.* sp. (?) Awerinzew
16) *C. acadiensis* Mavor
17) *C.* sp. Georgévitch
18) *C. coris* Georgévitch
19) *C. herouardi* Georgévitch
20) *C. mesospora* Davis
21) *C. sphairophora* Davis
22) *C. taenia* Davis
23) *C. attenuata* Davis
24) *C. recurvata* Davis
25) *C. lunata* Davis
26) *C. abbreviata* Davis
27) *C. flagellifera* Davis
28) *C. agglomerata* Davis
29) *C. amorpha* Davis
30) *C. monospora* Davis
31) *C. streptospora* Davis
32) *C. aggregata* Davis
33) *C. undulata* Davis
34) *C. navicularia* Davis
35) *C. spinosa* Davis

Genus 3 MYXOPROTEUS Doflein [3 species]

1) *M. ambiguus* (Thélohan) Doflein (type species)
2) *M. cordiformis* Davis
3) *M. cornutus* Davis

Genus 4 WARDIA nov. gen. [2 species]

1) *W. ovinocua* nov. spec. (type species)
2) *W. ohlmacheri* (Gurley) Kudo

Genus 5 MITRASPORA Fujita emend. Kudo [3 species]

1) *M. cyprini* Fujita (type species)
2) *M. caudata* (Parisi) Kudo
3) *M. elongata* nov. spec.

II Suborder SPHAEROSPOREA nom. nov. (see page 57)

I Family CHLOROMYXIDAE Thélohan

Genus 1 CHLOROMYXUM Mingazzini

[22 species]

1) *C. leydigi* Mingazzini (type species)
2) *C. caudatum* Thélohan
3) *C. quadratum* Thélohan
4) *C. fluviatile* Thélohan
5) *C. mucronatum* Gurley
6) *C. diploxys* (Gurley) Thélohan
7) *C. protei* Joseph
8) *C. truttae* Léger
9) *C. cristatum* Léger
10) *C. dubium* Auerbach
11) *C.* sp. Awerinzew
12) *C. thymalli* Lebzelter
13) *C. koi* Fujita
14) *C. magnum* Awerinzew
15) *C. funduli* Hahn
16) *C. misgurni* Kudo
17) *C. fujitai* Kudo
18) *C. clupeidae* Hahn
19) *C. granulosum* Davis
20) *C. trijugum* nov. spec.
21) *C. catostomi* nov. spec.
22) *C. wardi* nov. spec.

II Family SPHAEROSPORIDAE Davis

Genus 1 SPHAEROSPORA Thélohan

[10 species]

1) *S. divergens* Thélohan (type species)
2) *S. elegans* Thélohan
3) *S. rostrata* Thélohan
4) *S. masovica* Cohn
5) *S. platessae* Woodcock
6) *S. angulata* Fujita
7) *S.* sp. Davis
8) *S. polymorpha* Davis
9) *S.* (?) sp. Southwell et Prashad
10) *S. carassii* nov. spec.

Genus 2 SINUOLINEA Davis

[5 species]

1) *S. dimorpha* Davis (type species)
2) *S. capsularis* Davis
3) *S. arborescens* Davis
4) *S. opacita* Davis
5) *S. brachiophora* Davis

III Suborder PLATYSPOREA nom. nov. (see page 57)

I Family MYXIDIIDAE Thélohan

Genus 1 MYXIDIUM Bütschli

[26 species]

1) *M. lieberkühni* Bütschli (type species)
2) *M. incurvatum* Thélohan
3) *M. sphaericum* Thélohan
4) *M. histophilum* Thélohan
5) *M.* sp. Gurley
6) *M. danilewskyi* Laveran
7) *M. giganteum* Doflein
8) *M. barbatulae* Cépède
9) *M. giardi* Cépède
10) *M. pfeifferi* Auerbach
11) *M. inflatum* Auerbach
12) *M. bergense* Auerbach
13) *M. procerum* Auerbach
14) *M. mackiei* Bosanquet
15) *M. macrocapsulare* Auerbach
16) *M.* sp. Awerinzew
17) *M. depressum* Parisi
18) *M. oviforme* Parisi
19) *M. anguillae* Ishii
20) *M.* sp. Mavor
21) *M. gadi* Georgévitch
22) *M. glutinosum* Davis
23) *M. phyllium* Davis
24) *M. striatum* Cunha et Fonseca
25) *M. kagayamai* nov. spec.
26) *M. americanum* nov. spec.

Genus 2 SPHAEROMYXA Thélohan

[7 species]

1) *S. balbianii* Thélohan (type species)
2) *S. immersa* (Lutz) Thélohan
3) *S. incurvata* Doflein
4) *S. sabrazesi* Laveran et Mesnil
5) *S. hellandi* Auerbach
6) *S. exneri* Awerinzew
7) *S. gasterostei* Georgévitch

Genus 3 ZSCHOKKELLA Auerbach

[4 species]

1) *Z. hildae* Auerbach (type species)
2) *Z. nova* Klokacewa
3) *Z. acheilognathi* Kudo
4) *Z. globulosa* Davis

II Family MYXOSOMATIDAE Poche

Genus 1 MYXOSOMA Thélohan
[3 species]

1) *M. dujardini* Thélohan (type species)
2) *M.* (?) *lobatum* Nemeczek
3) *M. funduli* Kudo

Genus 2 LENTOSPORA Plehn
[6 species]

1) *L. cerebralis* (Hofer) Plehn (type species)
2) *L. multiplicata* Reuss
3) *L. encephalina* Mulsow
4) *L. asymmetrica* Parisi
5) *L. acuta* (Fujita) Kudo
6) *L. dermatobia* Ishii

III Family MYXOBOLIDAE Thélohan

Genus 1 MYXOBOLUS Bütschli
[63 species]

1) *M. mülleri* Bütschli (type species)
2) *M. piriformis* Thélohan
3) *M. unicapsulatus* Gurley
4) *M. fuhrmanni* Auerbach
5) *M. oculi-leucisci* Trojan
6) *M. toyamai* Kudo
7) *M. notatus* Mavor
8) *M.* sp. Kudo
9) *M. rohitae* Southwell et Prashad
10) *M. seni* Southwell et Prashad
11) *M. misgurni* nov. spec.
12) *M. pfeifferi* Thélohan
13) *M. inaequalis* Gurley
14) *M. dispar* Thélohan
15) *M. ellipsoides* Thélohan
16) *M. exiguus* Thélohan
17) *M. oviformis* Thélohan
18) *M. lintoni* Gurley
19) *M. globosus* Gurley
20) *M. oblongus* Gurley
21) *M. transovalis* Gurley
22) *M. obesus* Gurley
23) *M. cycloides* Gurley
24) *M. sphaeralis* Gurley
25) *M. anurus* Cohn
26) *M.* sp. Gurley
27) *M.* sp. Gurley
28) *M.* sp. Gurley
29) *M. cyprini* Doflein
30) *M. neurobius* Schuberg et Schröder
31) *M. aeglefini* Auerbach
32) *M. gigas* Auerbach
33) *M. volgensis* Reuss
34) *M. scardinii* Reuss
35) *M. physophilus* Reuss
36) *M. macrocapsularis* Reuss
37) *M. sandrae* Reuss
38) *M. bramae* Reuss
39) *M. cyprinicola* Reuss
40) *M. balleri* Reuss
41) *M. squamae* Keysselitz
42) *M. cordis* Keysselitz
43) *M. musculi* Keysselitz
44) *M.* sp. Miyairi
45) *M.* sp. Wegener
46) *M. permagnus* Wegener
47) *M. rotundus* Nemeczek
48) *M. minutus* Nemeczek
49) *M.* sp. Lebzelter
50) *M. magnus* Awerinzew
51) *M. carassii* Klokacewa
52) *M.* sp. Southwell
53) *M. funduli* Kudo
54) *M. pleuronectidae* (Hahn)
55) *M. capsulatus* Davis
56) *M. nodularis* Southwell et Prashad
57) *M. hylae* Johnston et Bancroft
58) *M. aureatus* Ward
59) *M. miyairii* nov. spec.
60) *M. koi* nov. spec.
61) *M. orbiculatus* nov. spec.
62) *M. discrepans* nov. spec.
63) *M. mesentericus* nov. spec.

Genus 2 HENNEGUYA Thélohan
[32 species]

1) *H. psorospermica* Thélohan (type species)
2) *H. texta* (Cohn) Labbé
3) *H. minuta* (Cohn) Labbé
4) *H. oviperda* (Cohn) Labbé
5) *H. lobosa* (Cohn) Labbé
6) *H. peri-intestinalis* Cépède
7) *H. media* Thélohan
8) *H. brevis* Thélohan
9) *H. schizura* (Gurley) Labbé
10) *H. creplini* (Gurley) Labbé

11) *H. linearis* (Gurley) Labbé
12) *H. gurleyi* Kudo
13) *H. strongylura* (Gurley) Labbé
14) *H. monura* (Gurley) Labbé
15) *H. kolesnikovi* (Gurley) Labbé
16) *H. macrura* (Gurley) Thélohan
17) *H. zschokkei* (Gurley) Doflein
18) *H.* sp. (Gurley) Labbé
19) *H.* sp. (Gurley) Labbé
20) *H. tenuis* Vaney et Conte
21) *H. nüsslini* Schuberg et Schröder
22) *H. legeri* Cépède
23) *H. acerinae* Schröder
24) *H. gigantea* Nemeczek
25) *H.* (?) sp. Nemeczek
26) *H. gasterostei* Parisi
27) *H. neapolitana* Parisi
28) *H. wisconsinensis* Mavor
29) *H. brachyura* Ward
30) *H. salminicola* Ward
31) *H. miyairii* nov. spec.
32) *H. mictospora* nov. spec.

Genus 3 HOFERELLUS Berg
[1 species]

1) *H. cyprini* Doflein

Appendix: Myxosporidia of unknown genera and species [11 forms]

1) Gen. et spec. incert. Leydig
2) Gen. et spec. incert. Leydig
3) Gen. et spec. incert. Leydig
4) Gen. et spec. incert. Heckel et Kner
5) Gen. et spec. incert. Borne
6) Gen. incert. *merlucii* Perugia
7) Gen. incert. *congri* Perugia
8) Gen. et spec. incert. Linton
9) Gen. et spec. incert. Mingazzini
10) Gen. et spec. incert. Nufer
11) Gen. et spec. incert. Mavor
12) Gen. et spec. incert. Mavor

DISTRIBUTION OF MYXOSPORIDIA

A. GEOGRAPHICAL DISTRIBUTION

As will be seen from List III, Myxosporidia are common parasites of fish in various parts of the world.

It is interesting to notice that the same species are found among fresh-water or marine fish from waters in widely separated countries. It is possible to think that Myxosporidia in marine fish may be carried into remote waters by the migration of their hosts, while those infecting fresh-water fish may be brought from one place to another by the transportation of infected fish for breeding purpose, etc. It should be noted in this connection that no intermediate host has yet been found in relation to myxosporidiosis.

The followings are the common species found in different localities:

Leptotheca parva Thél.	Marseille, Bergen
Ceratomyxa sphaerulosa Thél.	Monaco, Roscoff, Bergen
C. appendiculata Thél.	Roscoff, Marseille, Rovigno
C. drepanopsettae Awerinzew	Murman coast, Bergen, Woods Hole
Chloromyxum leydigi Ming.	Roscoff, Monaco, Napoli, Rovigno, Beaufort
C. quadratum Thél.	Roscoff, Marseille, Napoli, Beira
Sphaerospora elegans Thél.	Bretagne, Karlsruhe, Lago di Garda
S. divergens Thél.	Napoli, Roscoff, Smalfjorden
Myxidium lieberkühni Bütsch.	Lago Maggiore, France, Germany, Lake Mendota, Georgian Bay
M. incurvatum Thél.	Napoli, Monaco, Roscoff, Bergen, Beaufort
M. bergense Auerbach.	Bergen, St. Andrews
M. oviforme Parisi	Napoli, Norwegian coast
Sphaeromyxa balbianii Thél.	Roscoff, Napoli, Beaufort
Myxosoma dujardini Thél.	France, Germany, Tokio(?)

On the other hand, some species are limited to certain localities. Five species classified in the genus Sinuolinea by Davis are reported only from Beaufort, N. C., U. S. A. The two species of the genus Wardia have been found solely in the state of Illinois, U. S. A.

More detailed data are shown in the following list.

LIST II

ASIA

I Nippon

Myxosporidia of fresh water fish

1) Northern Part (Hokkaido)

Sapporo: *Mitraspora cyprini* Fujita
Chloromyxum koi Fujita
Sphaerospora angulata Fujita
Lentospora acuta (Fujita) Kudo

2) Central part (Hondo)

Tokio: *Mitraspora cyprini* Fujita
Chloromyxum misgurni Kudo
Chloromyxum fujitai Kudo
Sphaerospora carassii nov. spec.
Myxidium kagayamai nov. spec.
Zschokkella acheilognathi Kudo
Myxosoma dujardini (?) Thélohan
Myxobolus toyamai Kudo
Myxobolus misgurni, nov. spec.
Myxobolus koi nov. spec.

Numazu: *Myxidium anguillae* Ishii
Lentospora dermatobia Ishii

3) Southern part (Kiushiu)

Fukuoka: *Myxobolus* sp. Miyairi
Myxobolus miyairii nov. spec.
Henneguya miyairii nov. spec.

II India

A. Myxosporidia of fresh-water fish

Katwan, Mirzapore (U.P.): *Myxobolus* sp. Southwell

Mirpur, Decca district: *Myxobolus rohitae* Southwell et Prashad
Myxobolus seni Southwell et Prashad
Myxobolus nodularis Southwell et Prashad

B. Myxosporidian of reptiles

Bombay: *Myxidium mackiei* Bosanquet

III Burma

In the vicinity of Ruby Mines: *Sphaerospora* sp. Southwell et Prashad

IV Kamtschatka

?*Henneguya salminicola* Ward

AUSTRALIA

Myxosporidian of amphibia

In the vicinity of Sidney: *Myxobolus hylae* Johnston et Bancroft

AFRICA

A. Myxosporidia of fresh-water fish

Nile: *Myxobolus unicapsulatus* Gurley
Henneguya strongylura Gurley

B. Myxosporidia of marine fish

1) Indian Ocean

Algoa Bay: *Chloromyxum magnum* Awerinzew

Beira: *Chloromyxum quadratum* Thélohan

East London: *Chloromyxum magnum* Awerinzew

Lorenço Marques: *Ceratomyxa tylosuri* Awerinzew
Ceratomyxa spari Awerinzew
Ceratomyxa sp(?). Awerinzew
Ceratomyxa sp (?). Awerinzew
Sphaeromyxa exneri Awerinzew

2) South Atlantic Ocean

Lüderitz Bay: *Chloromyxum magnum* Awerinzew

NORTH AMERICA

I United States

A. Myxosporidia of fresh-water fish

1) From Rivers emptying into Atlantic Ocean

Carlius, Va. (tribt. of Potomac River):	*Myxobolus transovalis* Gurley
Columbia, S. C. (Santee River):	*Myxobolus globosus* Gurley
Kinston, N. C. (Neuse River):	*Myxobolus globosus* Gurley
West Falmouth, Mass.:	*Myxobolus* sp. Kudo
Woodbury, N. J. (Delaware River):	*Henneguya monura* Gurley

2) From Lakes and Rivers opening into the Gulf of Mexico

Fox River, trib. Mississippi:	*Myxobolus globosus* Gurley
Lake Mendota, Wis.:	*Myxidium lieberkühni* Bütschli
	Henneguya wisconsinensis Mavor et Strasser
Neches River, Palestin, Tex.:	*Henneguya macrura* (Gurley) Thélohan
Storm Lake, Ia.:	*Henneguya gurleyi* Kudo
Stony Creek, Ill.:	*Chloromyxum trijugum* nov. spec.
	Myxobolus orbiculatus nov. spec.
	Henneguya mictospora nov. spec.
Homer Park, Ill.:	*Chloromyxum trijugum* nov. spec.
	Myxobolus orbiculatus nov. spec.
Salt Fork, Urbana, Ill.:	*Wardia ovinocua* nov. gen. nov. spec.
	Chloromyxum catostomi nov. spec.
	Myxobolus discrepans, nov. spec.
Crystal Lake, Urbana, Ill.:	*Mitraspora elongata* nov. spec.
	Myxidium americanum nov. spec.
	Myxobolus mesentericus nov. spec.

3) From the rivers opening into the Great Lakes

Black River, Ohio:	Gen. et spec. incert. Linton
Put-In-Bay, Ohio:	*Myxobolus aureatus* Ward
	Henneguya brachyura Ward

B. Myxosporidia of marine fish (Atlantic Ocean)

Beaufort, N. C.:	*Leptotheca fusiformis* Davis
	Leptotheca scissura Davis
	Leptotheca lobosa Davis
	Leptotheca glomerosa Davis
	Ceratomyxa mesospora Davis
	Ceratomyxa sphairophora Davis
	Ceratomyxa taenia Davis
	Ceratomyxa attenuata Davis
	Ceratomyxa recurvata Davis
	Ceratomyxa lunata Davis
	Ceratomyxa abbreviata Davis
	Ceratomyxa flagellifera Davis
	Ceratomyxa agglomerata Davis
	Ceratomyxa amorpha Davis
	Ceratomyxa monospora Davis
	Ceratomyxa streptospora Davis
	Ceratomyxa aggregata Davis
	Ceratomyxa undulata Davis

Ceratomyxa navicularia Davis
Ceratomyxa spinosa Davis
Myxoproteus cordiformis Davis
Myxoproteus cornutus Davis
Chloromyxum leydigi Mingazzini
Chloromyxum granulosum Davis
Sphaerospora polymorpha Davis
Sinuolinea dimorpha Davis
Sinuolinea capsularis Davis
Sinuolinea arborescens Davis
Sinuolinea opacita Davis
Sinuolinea brachiophora Davis
Myxidium incurvatum Thélohan
Myxidium glutinosum Davis
Myxidium phyllium Davis
Sphaeromyxa balbianii Thélohan
Zschokkella globulosa Davis
Myxobolus capsulatus Davis

Woods Hole, Mass: *Ceratomyxa drepanopsettae* Awerinzew
Chloromyxum funduli Hahn
Chloromyxum clupeidae Hahn
Myxosoma funduli Kudo
Myxobolus lintoni Gurley
Myxobolus funduli Kudo
Myxobolus pleuronectidae Hahn

Locality unrecorded: *Henneguya schizura* (Gurley) Labbé

C. Myxosporidian of Amphibia

Sycamore, Ill.: *Wardia ohlmacheri* (Gurley) Kudo

II Canada

A. Myxosporidia of fresh-water fish

Georgian Bay (south. part): *Myxidium lieberkühni* Bütschli
Myxobolus notatus Mavor
Gen. et spec. incert. Mavor

B. Myxosporidia of marine fish (Atlantic Ocean)

Passamaquoddy Bay (at or near the mouth of St. Croix River), New Brunswick: *Ceratomyxa acadiensis* Mavor
Myxidium bergense Auerbach
M. sp. Mavor
Gen. et spec. incert. Mavor

III Alaska

Klutina Lake: *Chloromyxum wardi* nov. spec.
Stickeen River: *Henneguya salminicola* Ward

SOUTH AMERICA

A. Myxosporidia of fresh-water fish from the waters connected with Atlantic Ocean
Guiana: *Myxobolus inaequalis* Gurley
Surinam: *Myxobolus inaequalis* Gurley
Locality?: *Henneguya linearis* (Gurley) Labbé

B. Myxosporidian of marine fish (Atlantic Ocean)

Rio de Janeiro: *Myxidium striatum* Cunha et Fonseca

C. Myxosporidian of Amphibia

Brazil: *Sphaeromyxa immersa* (Lutz) Thélohan

EUROPE

I Italy

A. Myxosporidia of fresh-water fish from lakes and rivers opening into Adriatic Sea

Lago di Como:	*Mitraspora caudata* (Parisi) Kudo
	Myxidium lieberkühni Bütschli
Lago di Garda:	*Sphaerospora elegans* Thélohan
	Henneguya gasterostei Parisi
Lago di Varamo:	*Henneguya minuta* (Cohn)
Lago Maggiore:	*Myxidium lieberkühni* Bütschli
Milano:	*Myxidium lieberkühni* Bütschli
	Myxobolus pfeifferi Thélohan
Pavia:	*Myxobolus gigas* Auerbach
	Myxobolus ellipsoides Thélohan
	Henneguya peri-intestinalis Cépède
Ticino River:	*Henneguya minuta* (Cohn)

B. Myxosporidia of marine fish

1) Ligurian Sea

Genova: *Chloromyxum leydigi* Mingazzini
Gen. incert. *merluccii* Perugia
Gen. incert. *congri* Perugia

2) Tyrrhenian Sea

Napoli: *Leptotheca agilis* Thélohan
Leptotheca elongata Thélohan
Ceratomyxa arcuata Thélohan
Ceratomyxa appendiculata Thélohan
Ceratomyxa truncata Thélohan
Ceratomyxa inaequalis Doflein
Ceratomyxa linospora Doflein
Myxoproteus ambiguus (Thél.) Doflein
Chloromyxum leydigi Mingazzini
Choromyxum quadratum Thélohan
Sphaerospora divergens Thélohan
Myxidium incurvatum Thélohan
Myxidium giganteum Doflein
Myxidium depressum Parisi
Myxidium oviforme Parisi
Sphaeromyxa balbianii Thélohan
Sphaeromyxa incurvata Doflein
Sphaeromyxa sabrazesi Laveran et Mesnil
Lentospora asymmetrica Parisi
Myxobolus exiguus Thélohan
Myxobolus mülleri Bütschli
Henneguya neapolitana Parisi

II Monaco

Myxosporidia of fish from Ligurian Sea

Leptotheca elongata Thélohan
Ceratomyxa sphaerulosa Thélohan

Ceratomyxa arcuata Thélohan
Ceratomyxa pallida Thélohan
Ceratomyxa herouardi Georgévitch
Ceratomyxa sp. Georgévitch
Chloromyxum leydigi Mingazzini
Myxidium incurvatum Thélohan
Sphaeromyxa sabrazesi Laveran et Mesnil

III France

A. Myxosporidia of fresh-water fish

1) From Rivers opening into Atlantic Ocean

Aigne:	*Myxobolus pfeifferi* Thélohan
Bretagne:	*Sphaerospora elegans* Thélohan
Lorraine:	*Myxobolus oviformis* Thélohan
Nancy:	*Myxobolus pfeifferi* Thélohan
Marne:	*Myxobolus pfeifferi* Thélohan
Seine:	*Myxobolus pfeifferi* Thélohan
Paris:	*Chloromyxum fluviatile* Thélohan
Wimereux:	*Myxidium giardi* Cépède

2) From Rivers opening into Mediterranean Sea

Dauphiné:	*Myxobolus mülleri* Bütschli
Drac River:	*Myxobolus mülleri* Bütschli
	Myxobolus pfeifferi Thélohan
Grenoble:	*Chloromyxum cristatum* Léger
Isère River:	*Myxidium barbatulae* Cépède
	Myxobolus oviformis Thélohan
	Myxobolus mülleri Bütschli
	Myxobolus cycloides Gurley
	Henneguya légeri Cépède
Lac d'Annecy:	*Myxobolus mülleri* Bütschli
Lac de Paladru:	*Myxobolus cycloides* Gurley
Lac du Bourget:	*Myxobolus obesus* Gurley
	Henneguya peri-intestinalis Cépède
Lyon?:	*Henneguya tenuis* Vaney et Conte
Rhône River:	*Myxobolus pfeifferi* Thélohan
Saône River:	*Myxobolus pfeifferi* Thélohan

B. Myxosporidia of marine fish

1) From Atlantic Ocean

Arcachon	*Sphaeromyxa sabrazesi* Laveran et Mesnil
Concarneau:	*Ceratomyxa arcuata* Thélohan
	Chloromyxum leydigi Mingazzini
	Chloromyxum quadratum Thélohan
	Sphaerospora divergens Thélohan
	Myxidium incurvatum Thélohan
	Sphaeromyxa balbianii Thélohan
Le Croisic:	*Leptotheca elongata* Thélohan
	Leptotheca parva Thélohan
	Leptotheca renicola Thélohan
	Ceratomyxa appendiculata Thélohan
	Myxoproteus ambiguus (Thél.) Doflein
	Sphaerospora rostrata Thélohan

Concarneau: *Ceratomyxa arcuata* Thélohan
Chloromyxum leydigi Mingazzini
Chloromyxum quadratum Thélohan
Sphaerospora divergens Thélohan
Myxidium incurvatum Thélohan
Sphaeromyxa balbianii Thélohan

Roscoff: *Ceratomyxa sphaerulosa* Thélohan
Ceratomyxa arcuata Thélohan
Ceratomyxa appendiculata Thélohan
Chloromyxum leydigi Mingazzini
Chloromyxum quadratum Thélohan
Sphaerospora rostrata Thélohan
Sphaerospora divergens Thélohan
Myxidium incurvatum Thélohan
Myxidium gadi Georgévitch
Sphaeromyxa balbianii Thélohan
Sphaeromyxa sabrazesi Laveran et Mesnil
Sphaeromyxa gasterostei Georgévitch
Myxobolus mülleri Bütschli

Le-Vivier-sur-mer: *Leptotheca parva* Thélohan
Myxidium sphaericum Thélohan
Myxobolus exiguus Thélohan

St.-Valery-en-caux: *Ceratomyxa sphaerulosa* Thélohan

2) From Mediterranean coast

Marseille: *Leptotheca elongata* Thélohan
Leptotheca parva Thélohan
Leptotheca renicola Thélohan
Leptotheca hepseti Thélohan
Ceratomyxa arcuata Thélohan
Ceratomyxa pallida Thélohan
Ceratomyxa globulifera Thélohan
Ceratomyxa appendiculata Thélohan
Ceratomyxa reticularis Thélohan
Chloromyxum leydigi Mingazzini
Sphaerospora rostrata Thélohan
Myxidium incurvatum Thélohan
Myxidium sphaericum Thélohan
Sphaeromyxa balbianii Thélohan
Myxobolus exiguus Thélohan

Banyuls: *Leptotheca elongata* Thélohan
Leptotheca polymorpha (Thél.) Labbé
Ceratomyxa arcuata Thélohan
Ceratomyxa globulifera Thélohan
Ceratomyxa appendiculata Thélohan
Ceratomyxa reticularis Thélohan
Chloromyxum leydigi Mingazzini
Sphaerospora rostrata Thélohan
Myxidium incurvatum Thélohan
Myxidium sphaericum Thélohan
Sphaeromyxa balbianii Thélohan
Myxobolus exiguus Thélohan

Villefranche:	*Ceratomyxa pallida* Thélohan
	Ceratomyxa truncata Thélohan
	Ceratomyxa coris Georgévitch
	Sphaeromyxa balbianii Thélohan
Locality unknown:	*Leptotheca agilis* Thélohan
	Leptotheca perlata (Gurley) Labbé
	Myxidium lieberkühni Bütschli
	Myxidium histophilum Thélohan
	Myxosoma dujardini Thélohan
	Myxobolus piriformis Thélohan
	Myxobolus dispar Thélohan
	Myxobolus obesus Thélohan
	Henneguya psorospermica Thélohan
	Henneguya media Thélohan
	Henneguya brevis Thélohan
	Hoferellus cyprini Doflein

C. Myxosporidian in a reptile

Myxidium danilewskyi Laveran

IV Germany

A. Myxosporidia of fresh-water fish

1) From Rivers opening into North Sea

Throughout country:	*Myxobolus cyprini* Doflein
Berlin:	*Henneguya oviperda* (Cohn)
Bodensee:	*Chloromyxum dubium* Auerbach
	Myxobolus mülleri Bütschli
Gutach:	*Myxobolus neurobius* Schuberg et Schröder
	Henneguya nüsslini Schub. et Schröder
Karlsruhe and its vicinity:	*Chloromyxum mucronatum* Gurley
	Sphaerospora elegans Thélohan
	Myxidium lieberkühni Bütschli
	Myxidium pfeifferi Auerbach
	Myxidium macrocapsulare Auerbach
	Henneguya oviperda (Cohn)
	Henneguya lobosa (Cohn)
	Myxobolus gigas Auerbach
Leipzig:	*Myxobolus* sp. Gurley
Mosel:	*Myxobolus pfeifferi* Thélohan
	Myxobolus squamae Keysselitz
	Myxobolus cordis Keysselitz
	Myxobolus musculi Keysselitz
Neckar:	*Myxobolus exiguus* Thélohan (Heidelberg)
	Myxobolus mülleri Bütschli
	Myxobolus pfeifferi Thélohan
	Myxobolus squamae Keysselitz
	Myxobolus cordis Keysselitz
	Myxobolus musculi Keysselitz
	Henneguya psorospermica Thélohan
	Henneguya acerinae Schröder (Heidelberg)
Rhine:	*Myxidium lieberkühni* Bütschli
	Myxobolus mülleri Bütschli
	Henneguya psorospermica Thélohan
	Lentospora encephalina Mulsow

2) From Rivers opening into Baltic Sea

Alle:	*Myxobolus mülleri* Bütschli
Frisches Haff:	*Myxidium lieberkühni* Bütschli
	Myxosoma dujardini Thélohan
	Myxobolus piriformis Thélohan
	Myxobolus dispar Thélohan
	Myxobolus exiguus Thélohan
	Myxobolus oviformis Thélohan
	Myxobolus mülleri Bütschli
	Myxobolus cycloides Gurley
	Myxobolus anurus Cohn
	Myxobolus sp. Wegener
	Myxobolus permagnus Wegener
	Henneguya psorospermica Thélohan
	Henneguya texta (Cohn)
	Henneguya minuta (Cohn)
	Henneguya lobosa (Cohn)
	Henneguya creplini (Gurley)
Kurisches Haff:	*Myxosoma dujardini* Thélohan
	Myxobolus exiguus Thélohan
	Myxobolus oviformis Thélohan
	Myxobolus cycloides Gurley
	Henneguya psorospermica Thélohan
	Henneguya texta (Cohn)
	Henneguya creplini (Gurley) Labbé
Masurische Seen:	*Sphaerospora masovica* Cohn
	Myxobolus dispar Thélohan
	Myxobolus ellipsoides Thélohan
	Myxobolus cycloides Gurley
	Myxobolus anurus Cohn
	Henneguya psorospermica Thélohan
	Henneguya texta (Cohn)
Pregel:	*Myxosoma dujardini* Thélohan
	Myxobolus piriformis Thélohan
	Myxobolus dispar Thélohan
	Myxobolus exiguus Thélohan
	Myxobolus oviformis Thélohan
	Myxobolus mülleri Bütschli
	Myxobolus cycloides Gurley
	Myxobolus anurus Cohn
	Myxobolus permagnus Wegener
	Henneguya psorospermica Thélohan
	Henneguya texta (Cohn)
	Henneguya minuta (Cohn)
	Henneguya lobosa (Cohn)
	Henneguya creplini (Gurley) Labbé
Weichsel:	*Myxobolus cyprini* Doflein

3) Localities unknown:	*Chloromyxum leydigi* Mingazzini
	Myxidium lieberkühni Bütschli
	Myxidium sp. Gurley
	Lentospora cerebralis (Hofer) Plehn

	Henneguya schizura (Gurley) Labbé
	Hojerellus cyprini Doflein
	Gen. et spec. incert. Leydig
	Gen. et spec. incert. Leydig
	Gen. et spec. incert. Leydig
	Gen. et spec. incert. Borne

V NETHERLAND

Myxosporidian of marine fish

Helder:	*Chloromyxum quadratum* Thélohan

VI ENGLAND

Myxosporidia of marine fish

Firth of Clyde, Morecamb, etc.:	*Myxobolus aeglefini* Auerbach
Liverpool (?):	*Sphaerospora platessae* Woodcock

VII NORWAY

Myxosporidia of marine fish

Abelvaer:	*Myxidium bergense* Auerbach
	Myxidium oviforme Parisi
	Zschokkella hildae Auerbach
	Myxobolus aeglefini Auerbach
Bergen:	*Leptotheca parva* Thélohan
	Leptotheca macrospora Auerbach
	Leptotheca informis Auerbach
	Leptotheca longipes Auerbach
	Ceratomyxa sphaerulosa Thélohan
	Myxidium incurvatum Thélohan
	Myxidium inflatum Auerbach
	Myxidium bergense Auerbach
	Myxidium procerum Auerbach
	Sphaeromyxa hellandi Auerbach
	Zschokkella hildae Auerbach
	Myxobolus aeglefini Auerbach
Bergsfjord:	*Myxidium bergense* Auerbach
	Zschokkella hildae Auerbach
Boadsfjord:	*Zschokkella hildae* Auerbach
Bodö:	*Myxidium bergense* Auerbach
	Zschokkella hildae Auerbach
Finkongkjeilen:	*Myxidium bergense* Auerbach
	Zschokkella hildae Auerbach
Grönöy:	*Myxidium bergense* Auerbach
	Zschokkella hildae Auerbach
Hammerfest:	*Myxidium bergense* Auerbach
	Myxidium oviforme Parisi
	Zschokkella hildae Auerbach
Harstad:	*Myxidium bergense* Auerbach
	Zschokkella hildae Auerbach
Honnigsvaag:	*Myxidium bergense* Auerbach
	Zschokkella hildae Auerbach
Kabelvaag:	*Ceratomyxa drepanopsettae* Awerinzew

	Myxidium bergense Auerbach
	Zschokkella hildae Auerbach
Kiberg:	*Zschokkella hildae* Auerbach
Kirkenes:	*Myxidium bergense* Auerbach
Kristiana:	*Myxidium bergense* Auerbach
Kristiansand:	*Leptotheca parva* Thélohan
	Leptotheca macrospora Auerbach
	Myxidium oviforme Parisi
	Zschokkella hildae Auerbach
Lödingen:	*Myxobolus aeglefini* Auerbach
Makur:	*Myxidium bergense* Auerbach
	Zschokkella hildae Auerbach
Mosjöen:	*Zschokkella hildae* Auerbach
	Myxidium bergense Auerbach
Nusfjord:	*Myxidium bergense* Auerbach
	Zschokkella hildae Auerbach
Rörvik:	*Ceratomyxa drepanopsettae* Awerinzew
	Myxidium bergense Auerbach
Rossfjord:	*Myxidium oviforme* Parisi
Skjervö:	*Zschokkella hildae* Auerbach
Skjötningsberg:	*Zschokkella hildae* Auerbach
	Myxidium bergense Auerbach
Smalfjorden:	*Sphaerospora divergens* Thélohan
	Zschokkella hildae Auerbach
Stavanger:	*Leptotheca parva* Thélohan
	Myxidium bergense Auerbach
Svolvaer:	*Myxidium bergense* Auerbach
	Zschokkella hildae Auerbach
Tjömö:	*Leptotheca informis* Thélohan
	Ceratomyxa drepanopsettae Awerinzew
	Myxidium bergense Auerbach
Torghatten:	*Sphaeromyxa hellandi* Auerbach
Trondhjem:	*Myxidium bergense* Auerbach
	Myxidium oviforme Parisi
	Zschokkella hildae Auerbach
Vikholmen:	*Zschokkella hildae* Auerbach
Vardö:	*Myxidium bergense* Auerbach
	Myxidium oviforme Parisi
	Zschokkella hildae Auerbach
	Myxobolus aeglefini Auerbach

VIII Switzerland

Myxosporidia of fresh-water fish

1) From Lakes connected with North Sea

Neuchatel:	*Myxobolus fuhrmanni* Auerbach
	Myxobolus mülleri Bütschli
	Henneguya oviperda (Cohn)
	Henneguya zschokkei (Gurley) Doflein
Thun:	*Henneguya zschokkei* (Gurley) Doflein
Zurich:	*Henneguya zschokkei* (Gurley) Doflein
Lucerne:	*Myxosoma dujardini* Thélohan
	Myxobolus ellipsoides Thélohan

	Myxobolus oviformis Thélohan
	Myxobolus mülleri Bütschli
	Henneguya psorospermica Thélohan
	Henneguya texta (Cohn)
	Henneguya zschokkei (Gurley) Doflein
	Gen. et spec. incert. Nufer
Wallen:	*Henneguya zschokkei* (Gurley) Doflein

2) From Lake connected with Mediterranean Sea

Geneva:	*Myxobolus sphaeralis* Gurley
	Henneguya zschokkei (Gurley) Doflein

IX Austria

A. Myxosporidia of fresh-water fish

1) From Rivers opening into Black Sea

Danube tributaries and Neusiedler:	*Chloromyxum thymalli* Lebzelter
	Myxosoma (?) *lobatum* Nemeczek
	Myxobolus aeglefini Auerbach
	Myxobolus cyprini Doflein
	Myxobolus rotundus Nemeczek
	Myxobolus minutus Nemeczek
	Myxobolus sp. Lebzelter
	Henneguya acerinae Schröder
	Henneguya gigantea Nemeczek

2) From Rivers opening into North Sea

Prag:	*Myxosoma dujardini* Thélohan
	Myxobolus ellipsoides Thélohan
	Myxobolus oculi-leucisci Trojan
Krakau:	*Myxobolus cyprini* Doflein

B. Myxosporidia of marine fish (Adriatic Sea)

Rovigno:	*Leptotheca agilis* Thélohan
	Ceratomyxa pallida Thélohan
	Ceratomyxa appendiculata Thélohan
	Myxoproteus ambiguus (Thél.) Doflein
	Chloromyxum leydigi Mingazzini
	Sphaeromyxa sabrazesi Laveran et Mesnil
Locality unknown:	Gen. et spec. incert. Heckel et Kner

C. Myxosporidian of Amphibia

Vienna:	*Chloromyxum protei* Joseph

X Serbia

Pergrad (Danube):	*Henneguya gigantea* Nemeczek

XI Russia

A. Myxosporidia of fresh-water fish

Volga (to Caspian Sea):	*Lentospora multiplicata* Reuss
	Myxobolus volgensis Reuss
	Myxobolus scardinii Reuss
	Myxobolus physophilus Reuss
	Myxobolus macrocapsularis Reuss
	Myxobolus sandrae Reuss
	Myxobolus bramae Reuss
	Myxobolus cyprinicola Reuss
	Myxobolus balleri Reuss

Don (to Black Sea):	*Myxobolus* sp. Gurley
Locality unknown:	*Zschokkella nova* Klokacewa
	Myxobolus magnus Awerinzew
	Myxobolus carassii Klokacewa
	Henneguya kolesnikovi (Gurley) Labbé

B. Myxosporidia of marine fish from Arctic Ocean

Murman coast:	*Ceratomyxa ramosa* Awerinzew
	Ceratomyxa drepanopsettae Awerinzew
	Myxidium sp. Awerinzew
	Leptotheca sp. Awerinzew
	Chloromyxum sp. Awerinzew

B. DISTRIBUTION OF MYXOSPORIDIA IN ANIMALS

The number of host species that harbor Myxosporidia is 237, as will be seen from List III.

Tho two incompletely studied forms are found in Annelida and Insecta, Myxosporidia are the parasites of Vertebrata, especially of Pisces, only few being found infecting Amphibia and Reptilia. They are distributed among these groups of animals as follows:

	Number of host species
Annelida	1
Insecta	1
Pisces	223
Amphibia	8
Reptilia	4

Gurley (1894:101–105), Wasielewsky (1896:132–148), Labbé (1899: 133–161) and Auerbach (1910: 36–45; 1911:471–494) gave lists in which they recorded the names of host species. Wasielewsky arranged the names alphabetically while others listed them according to their systematic order. In the following pages, the writer followed Wasielewsky, i.e., the names of the host species are arranged alphabetically as is supposed to be more convenient in referring to the host than any form presented otherwise.

LIST III. LIST OF HOST SPECIES

Host	Organ Infected	Myxosporidian	Locality
Annelida			
Nais lacustris (*N. proboscidea*)	Unknown	*Myxobolus* sp.	Germany
Insecta			
Tortrix viridana L. (imago)	Abdominal cavity	*Chloromyxum diploxys*	France
Pisces			
Abramis ballerus L.	Branchiae	*Myxobolus balleri*	Russia
A. brama L.	"	*bramae*	"

Host	Organ Infected	Myxosporidian	Locality
	Branchiae	*Myxobolus cycloides*	Germany
	"	*ellipsoides*	" (?)
	"	*exiguus*	France
	"	*oviformis*	France
	"	*rotundus*	Austria
	Gall-bladder	*Sphaerospora masovica*	Germany
	Kidney	*Myxobolus cyprini*	" , Hungary
	Subcut. conn. tissue of operculum	*gigas*	Germany, Italy
A. vimba L.	Branchiae	*cycloides*	Germany
	"	*ellipsoides*	" (?)
	"	*oviformis*	Germany
Acanthias acanthias L.	Gall-bladder	*Chloromyxum leydigi*	France
A. blainvillei	"	*magnum*	Africa
Acerina cernua L.	Branchiae	*Henneguya acerinae*	Germany
	" , Muscle	*creplini*	"
	Conn. tissue of aliment. canal	*tenuis*	France
	Eye	*Myxobolus magnus*	Russia
	Muscle	*Leptotheca perlata*	France?
Acheilognathus lanceolatum Temm. et Schl.	Gall-bladder, Gall-duct	*Zschokkella acheilognathi*	Nippon
Alburnus alburnus L. (*A. lucidus* Heck)	Branchiae	*Myxobolus cycloides*	Germany
	"	*dispar*	"
	"	*ellipsoides*	Germany ?
	"	*oviformis*	France
	" , kidney	*obesus*	"
	Muscle and spleen	*dispar*	"
	Eye	*mülleri*	Switzerland
Alosa finta Cuv. var. *lacustris* Fatio	Kidney	*Mitraspora caudata*	Italy
Ameiurus melas Raf.	Base of spines of 2nd dorsal fin	*Henneguya gurleyi*	U. S. A.
Ancylopsetta quadrocellata Gill	Gall-bladder	*Ceratomyxa undulata*	"
Anguilla japonica Temm. et Schl.	Integument	*Myxidium anguillae*	Nippon
	"	*Lentospora dermatobia*	"
A. vulgaris Flemm.	Kidney	*Myxidium giardi*	France
Aphredoderus sayanus Gill.	Subcutaneous intermusc. tiss.	*Henneguya monura*	U. S. A.
Apogon rex-mullorum Cuv.	Gall-bladder	*Myxidium oviforme*	Italy
Argentina silus Nilss.	"	*procerum*	Norway
Ariodes polystaphylodon	Muscle	*Chloromyxum quadratum*	Africa
Aspius rapax Ag.	Branchiae	*Myxosoma*(?) *lobatum*	Austria
Aspro asper L.	"	*Myxobolus mülleri*	France
A. zingel Cuv.	"	*Henneguya acerinae*	"

Host	Organ Infected	Myxosporidian	Locality
Atherina hepsetus L.	Gall-bladder	*Leptotheca hepseti*	France
Bairdiella chrysura	Urin. bladder	*Myxoproteus cornutus*	U. S. A.
B. rouchus Cuv. et Val.	Gall-bladder	*Myxidium striatum*	Brazil
Barbus barbus L. (*B. fluviatilis*)	Kidney, spleen, intestine, ovary, etc.	*Myxobolus pfeifferi*	France, Germany
	Inner surface of scale	*squamae*	Germany
	Muscle of ventricle	*cordis*	"
	Muscle, kidney	*musculi*	"
B. plebejus Val.	"	*pfeifferi*	Italy
B. vulgaris Flem.	Branchiae	*mülleri*	Germany
Barilius barna	Under scales	*Sphaerospora* sp.	Burma
Belone acus Risso	Gall-bladder	*Myxidium sphaericum*	France
B. belone L.	"	*Myxidium sphaericum*	"
Blennius ocellatus	"	*Sphaeromyxa incurvata*	Italy
B. gattorugine Brunn.	Kidney	*Chloromyxum quadratum*	"
B. pholis L.	Gall-bladder	*Myxidium incurvatum*	France
	Renal tubules	*Sphaerospora divergens*	"
Blicca björkna L.	Branchiae	*Myxobolus cycloides*	Germany
	"	*ellipsoides*	" ?
	"	*macrocapsularis*	Russia
	"	*oviformis*	Germany
Box boops L.	Gall-bladder	*Ceratomyxa pallida*	France, Italy
B. salpa L.	Gall-bladder	*Ceratomyxa herouardi*	Monaco
	"	*pallida*	France, Italy
	Kidney	*Henneguya neapolitana*	Italy
Brevoortia tyrannus Latr.	Muscle	*Chloromyxum clupeidae*	U. S. A.
Brosmius brosme Ascanius	Gall-bladder	*Leptotheca longipes*	Norway
	"	*Sphaeromyxa hellandi*	"
Callionymus lyra L.	"	*Myxidium incurvatum*	France, Norway
	Muscle	*Chloromyxum quadratum*	France
Carassius auratus L.	Branchiae	*Lentospora acuta*	Nippon
	Kidney	*Sphaerospora angulata*	"
	"	*Mitraspora cyprini*	"
	Subcutaneous tiss. of head	*Henneguya miyairii*	"
(*C. carassius* L.)	Body cavity	*Myxobolus* sp.	Germany
	Branchiae	*dispar*	"
	"	*Sphaerospora carassii*	Nippon
(*C. vulgaris* L.)	Body cavity, liver, intestine	*Myxobolus carassii*	Russia
	Gall-bladder	*Zschokkella nova*	"
Carcharhinus limbatus	"	*Chloromyxum leydigi*	U. S. A.
C. sp.	"	*Ceratomyxa flagellifera*	"

Host	Organ Infected	Myxosporidian	Locality
Carpiodes difformis	Branchiae	*Myxobolus discrepans*	U. S. A.
Catostomus commersonii Lac.	Gall-bladder	*Chloromyxum catostomi*	"
Centronotus gunellus	"	*Sphaeromyxa hellandi*	Norway
Cepola rubescens L.	"	*balbianii*	France
Cestracion tiburo	"	*Chloromyxum leydigi*	U. S. A.
	"	*Ceratomyxa mesospora*	"
C. zygaena	"	*Ceratomyxa mesospora*	"
	"	*recurvata*	"
	"	*Chloromyxum leydigi*	"
	"	*Leptotheca fusiformis*	"
Chaetodipterus faber	Gall-bladder	*Ceratomyxa streptospora*	"
	Urin. bladder	*Myxoproteus cordiformis*	"
Chondrostoma nasus L.	Branchiae	*Myxobolus exiguus*	Germany
	"	Gen. et spec. incert.	Switzerland
	Tongue	Gen. et spec. incert.	?
Citharus linguata Gthr.	Gall-bladder	*Myxidium depressum*	Italy
Clupea harengus Young	"	*Ceratomyxa sphaerulosa*	Norway
	Muscle	*Chloromyxum clupeidae*	U. S. A.
C. pilchardus Walb. (*Alosa sardina*)	Gall-bladder	*Ceratomyxa truncata*	France, Italy
	"	*Sphaeromyxa balbianii*	Italy
Cobitis barbatula L.	Kidney	*Myxidium barbatulae*	France
	Urin. bladder	*Henneguya legeri*	"
C. fossilis L.	Branchiae, kidney, spleen	*Myxobolus piriformis*	Germany
Conger conger L. (*Leptocephalus c.*)	Gall-bladder	Gen. incert. *congri*	Italy
Coregonus lavaretus L. (*C. fera*)	Branchiae	*Henneguya* sp.	France?
	" (mucosa)	*Myxobolus sphaeralis*	Switzerland
	Muscle	*Henneguya kolesnikovi*	Russia
	"	*zschokkei*	Switzerland
C. exiguus albellus	" , branchia	"	"
C. wartmanni nobilis	" "	"	"
Coris giofredi Risso	Gall-bladder	*Ceratomyxa coris*	France
C. julis L.	"	"	"
	Muscle	*Chloromyxum quadratum*	"
	Gall-bladder	*Myxidium oviforme*	Italy
Cottus gobis L.	Branchiae	*Myxobolus mülleri*	France
C. scorpius	"	*Myxidium* sp.	Russia
Crenilabrus mediterraneus	"	*Ceratomyxa inaequalis*	Italy
C. melops L.	Eye	*Myxobolus mülleri*	Germany France
	Gall-bladder	*Ceratomyxa arcuata*	France
	Kidney	*Sphaerospora divergens*	"
C. pavo Cuv. et Val.	Gall-bladder	*Ceratomyxa inaequalis*	Italy
	Kidney	*Lentospora asymmetrica*	Italy
	"	*Sphaerospora divergens*	France, Italy
Cyclopterus lumpus L.	Gall-bladder	*Myxidium inflatum*	Norway

Host	Organ Infected	Myxosporidian	Locality
Cynoscion regalis...............	Gall-bladder	*Myxidium glutinosum*	U. S. A.
	Urin. bladder, ureters	*Sinuolinea dimorpha*	"
Cyprinodon variegatus..........	Subcutaneous tissue	*Myxobolus lintoni*	"
	Visceral conn. tissue	*capsulatus*	"
Cyprinus carpio L...............	Branchiae	*cyprinicola*	Russia
	"	*dispar*	France, Germany
	"	*oviformis*	France ?
	"	*toyamai*	Nippon
	"	*Myxosoma dujardini*	France
	"	*Myxobolus koi*	Nippon
	Brain	*Lentospora encephalina*	Germany
	Gall-bladder	*Chloromyxum koi*	Nippon
	Kidney	*Hoferellus cyprini*	Germany, France
	" liver, spl.	*Myxobolus cyprini*	Germany, Hungary
	Kidney	*Mitraspora cyprini*	Nippon
	"	*Sphaerospora angulata*	"
C. (*Rasbora*) *daniconius* Day....................................	Subcutaneous intermuscular tissue	*Myxobolus* sp.	India
	Muscles	*Myxobolus nodularis*	India
Dasybatis hastatus...............	Gall-bladder	*Chloromyxum leydigi*	U. S. A.
	"	*Leptotheca scissura*	"
D. sabina.............................	"	*Chloromyxum leydigi*	"
Drepanopsetta platessoides Fabr...................................	"	*Ceratomyxa drepanopsettae*	Russia
Erimyzon sucetta oblongus Lac (*Catostomus tuberculatus*)	Branchiae	*Myxobolus globosus*	U. S. A.
	Integument	*oblongus*	"
Esox lucius L......................	Branchiae	*anurus*	Germany
	"	*Henneguya lobosa*	"
	"	*Henneguya psorospermica*	France, Germany
	Intestinal wall	*Henneguya peri-intestinalis*	France, Italy
	Eye muscle, etc.	*Henneguya schizura*	U. S. A.
	Ovary	*Henneguya oviperda*	Germany, Switzerland
	Urin. bladder	*Myxidium lieberkühni*	France, Italy, Canada, U. S. A., Germany
Fundulus sp..........................	Muscle	*Chloromyxum funduli*	U. S. A.

Host	Organ Infected	Myxosporidian	Locality
F. diaphanus	Muscle	*Myxobolus funduli*	U. S. A.
F. heteroclitus	Branchiae, Muscle	*Myxobolus funduli*	"
	Branchiae	*Myxosoma funduli*	"
F. majalis	"	*Myxosoma funduli*	"
	", muscle	*Myxobolus funduli*	"
	Gall-bladder	*Myxidium incurvatum*	"
Gadus aeglefinis L.	Cartilage	*Myxobolus aeglefini*	Germany
	Urin. bladder	*Zschokkella hildae*	Norway
G. callarias L.	Cartilage	*Myxobolus aeglefini*	Germany
	Gall-bladder	*Myxidium oviforme*	Norway
	Urin. bladder	*Zschokkella hildae*	Norway
G. esmarkii Nilss.	Cartilage, bone of cranium, eye	*Myxobolus aeglefini*	Germany, England
G. merlangus L.	Gall-bladder	*Leptotheca informis*	Norway
	Cartilage	*Myxobolus aeglefini*	Germany
G. morrhua L.	Cartilage	*Myxobolus aeglefini*	Germany
G. pollachius L.	Gall-bladder	*Myxidium gadi*	France
G. virens L.	"	*bergense*	Norway
	Urin. bladder	*Zschokkella hildae*	"
Galeocerda tigrinus	Gall-bladder	*Ceratomyxa lunata*	U. S. A.
Galeus galeus L. (*G. canis*)	"	*sphaerulosa*	France
Gambusia affinis	"	*Myxidium incurvatum*	U. S. A.
	"	*phyllium*	"
Gasterosteus aculeatus	Kidney (r. t.), ovary	*Henneguya media*	France
	"	*brevis*	"
	"	*Sphaerospora elegans*	", Italy
	Kidney	*Henneguya gasterostei*	Italy
G. pungitius L.	" (r. t.), ovary	*brevis*	France
	"	*media*	"
	"	*Sphaerospora elegans*	"
G. spinachia	Gall-bladder	*Sphaeromyxa gasterostei*	"
Gobio gobio L. (*G. fluviatilis*)	Fin	*Myxobolus mülleri*	Germany
	Fin, spleen, kidney, liver	*oviformis*	France
	Branchiae	*cycloides*	Germany
Gobius fluviatilis L.	Body-cavity	Gen. et. spec. incert.	"
Gobius paganellus L.	Gall-bladder	*Ceratomyxa arcuata*	Italy
Heliases chromis Gthr.	"	*Ceratomyxa arcuata*	Italy, Monaco
Hippocampus brevirostris Cuv.	"	*Myxidium incurvatum*	Italy
	"	*Sphaeromyxa sabrazesi*	France, Italy, Hungary

Host	Organ Infected	Myxosporidian	Locality
H. guttulatus Cuv.	Gall-bladder	*Sphaeromyxa sabrazesi*	Fr., Hun., Monaco
Hippoglossoides limandoides	Urin. bladder	*Sphaerospora divergens*	Norway
Hippoglossus vulgaris Flemm.	Gall-bladder	*Ceratomyxa drepanopsettae*	Norway
	"	*ramosa*	Russia
Hybognathus nuchalis Ag.	Conn. tissue of the head	*Henneguya macrura*	U. S. A.
Idus melanotus Heck.	Branchiae	*Myxobolus ellipsoides*	Germany?
	Muscle	*Lentospora multiplicata*	Russia
Labeo rohita	Branchiae	*Myxobolus rohitae*	India
	Fins	*Myxobolus seni*	"
Labeo niloticus Forsk.	?	*Myxobolus unicapsulatus*	Egypt
Labrus turdus	Gall-bladder	*Ceratomyxa linospora*	Italy
Leiostomus xanthurus	"	*aggregata*	U. S. A.
Lepisosteus platystomus	Urinary bladder	*Sphaerospora* sp.	"
Lepomis cyanellus Raf.	Mesentery	*Myxobolus mesentericus*	"
	Urin. bladder	*Henneguya mictospora*	"
	Kidney	*Mitraspora elongata*	"
L. humilis Girard	Ovary	*Wardia ovinocua*	"
	Urinary bladd.	*Henneguya mictospora*	"
L. megalotis Raf.	Gall-bladder	*Chloromyxum trijugum*	"
Leuciscus cephalus (*Squalis cephalus*)	Air-bladder, branchiae	*Myxobolus mülleri*	France, Germany
	Branchiae	*ellipsoides*	", "
	Gall-bladder	*Chloromyxum fluviatile*	France
L. lucius L.	Branchiae	*Myxobolus* sp.	Germany?
L. phoxinus L. (*Phoxinus laevis* Ag.)	Conn. tiss. of kidney; ovary	*Myxidium histophilum*	France
	"	*Myxobolus mülleri*	"
L. rutilus L.	Branchiae	*ellipsoides*	Germany?
	"	*mülleri*	"
	"	*Myxosoma dujardini*	France
	Conn. tiss. under the mouth muc. membrane	*Myxobolus fuhrmanni*	Switzerland
	Opercle, pseudo branchiae, kidney	*cycloides*	France, Germany
	Vitreous body of eye	*oculi-leucisci*	Austria
	?	*Henneguya* sp.	Germany
	Heart	Gen. et spec. incert.	"
Leuciscus sp.	Branchiae	*Myxobolus minutus*	Austria
	"	*Myxosoma* (?) *lobatum*	"
Lophius budegassa Spin.	Gall-bladder	*Ceratomyxa appendiculata*	Italy, France
L. piscatorius L.	"	*Ceratomyxa appendiculata*	"

Host	Organ Infected	Myxosporidian	Locality
L. piscatorius L.	Urin. bladder	*Myxoproteus ambiguus*	France, Italy, Hungary
Lota lota L. (*L. vulgaris*)	Branchiae	*Myxobolus mülleri*	Germany
	"	*Myxobolus cycloides*	Germany
	Gall-bladder	*Chloromyxum dubium*	" , Austria
	Urin. bladder, kidney	*mucronatum*	France
	Urin. bladder	*Myxidium lieberkühni*	France, Germany
	"	*Sphaerospora elegans*	Germany
Lucioperca lucioperca L. (*L. sandra* Cuv.)	Branchiae	*Henneguya acerinae*	" , Austria
	" , head, fin, opercle	*Myxobolus* sp.	?
	"	*Henneguya gigantea*	Aus., Servia
	"	Gen. et sp. incert.	Austria
	Muscle	*Myxobolus sandrae*	Russia
L. volgensis Pall.	Branchiae, cornea, dorsal fin	*volgensis*	"
Melanogrammus aeglefinis	Gall-bladder	*Myxidium bergense*	Canada
Menticirrhus americanus L.	"	*striatum*	Brazil
Merluccius merluccius L. (*M. vulgaris*)	"	*Ceratomyxa globulifera*	France
	"	*Leptotheca elongata*	" , Italy
	"	Gen. incert. *merluccii*	Italy
Micropogon undulatus	"	*Ceratomyxa aggregata*	U. S. A.
Micropterus salmoides Lac.	Urin. Bladder	*Henneguya mictospora*	U. S. A.
Misgurnus anguillicaudatus Cantor	Branchiae	*Myxobolus* sp.	Nippon
	Gall-bladder	*Chloromyxum fujitai*	"
	"	*misgurni*	"
	"	*Myxidium kagayamai*	"
	"	*Myxobolus misgurni*	"
Molva vulgaris Flem.	Bone	*aeglefini*	Austria
	Gall-bladder	*Leptotheca informis*	Norway
	"	*Sphaeromyxa hellandi*	"
Motella maculata Risso	"	*balbianii*	France
M. tricirrata Bl.	"	*Ceratomyxa arcuata*	"
	"	*Leptotheca elongata*	", Monaco
	"	*Sphaeromyxa balbianii*	France
	"	*sabrazesi*	Monaco
Mugil auratus Risso	Intestine, stomach, spleen, pyloric coecum	*Myxobolus mülleri*	Italy
	Kidney	*exiguus*	", France
M. capito Cuv.	"	*exiguus*	"
M. cephalus L.	Gall-bladder	*Myxidium incurvatum*	U. S. A.
M. chelo Cuv.	Stomach, spleen, kidney, etc.	*Myxobolus exiguus*	Italy, France

Host	Organ Infected	Myxosporidian	Locality
M. sp.	Kidney	*Sphaerospora rostrata*	Italy, France
Muraena sp.	Gall-bladder	*Ceratomyxa* sp.	Monaco
Mustelus canis Mitch. (*M. vulgaris*)	Gall-bladder	*Ceratomyxa sphaerulosa*	France
Nerophis aequoreus L.	Gall-bladder	*Myxidium incurvatum*	France
	Muscle	*Chloromyxum quadratum*	"
N. annulatus	Gall-bladder	*Myxidium incurvatum*	"
	"	*Sphaeromyxa sabrazesi*	Monaco
N. lumbriciformis	"	*Myxidium incurvatum*	France
Notropis megalops Raf.	Subcut. tissue	Gen. et spec. incert.	U. S. A.
N. gilberti J. et M.	Muscle	*Myxobolus orbiculatus*	U. S. A.
N. blennius	"	"	"
N. anogenus	Fins	*aureatus*	"
	"	*Henneguya brachyura*	"
Oncorhynchus keta	Under the skin	*Henneguya salminicola*	Kamtschatka
O. kisutch	"	"	"
	Connective tiss. of body muscle	"	Alaska
O. nerka	Gall-bladder	*Chloromyxum wardi*	"
Ophidium vasalli	Gall-bladder	*Ceratomyxa arcuata*	Monaco
Opsanus tau	Urin. bladder	*Sphaerospora polymorpha*	U. S. A.
Pagellus centrodontus Del.	Gall-bladder	*Ceratomyxa arcuata*	France, Italy
Paralichthys albiguttus J. et G.	Urin. bladder	*navicularia*	U. S. A.
	"	*spinosa*	"
	"	*Leptotheca glomerosa*	"
	"	*Sinuolinea brachiophora*	"
	"	*capsularis*	"
	"	*opacita*	"
P. dentatus	Gall-bladder	*Ceratomyxa drepanopsettae*	"
	Urin. bladder	*navicularia*	"
	"	*Leptotheca lobosa*	"
	"	*Sinuolinea capsularis*	"
Parasilurus asotus L.	Intestinal wall	*Myxobolus miyairii*	Nippon
Peprilus alepidotus	Gall-bladder	*Ceratomyxa monospora*	U. S. A.
Perca flavescens	Spleen	*Myxobolus* sp.	"
	Urin. bladder	*Henneguya wisconsinensis*	"
P. fluviatilis	Branchiae	*texta*	Italy, Germany
	"	*Henneguya minuta*	"
	"	*Myxobolus* sp.	Germany
	" , operculum	*permagnus*	"
	"	*Myxosoma dujardini*	Switzerland
	"	*Henneguya psorospermica*	"
Phoxinus (*Clinostomus*) *funduloides* Girard	Under scales on ext. surf.	*Myxobolus transovalis*	U. S. A.
P. laevis	Branchiae	*mülleri*	France

Host	Organ Infected	Myxosporidian	Locality
P. laevis	Kidney, ovary	*Myxidium histophilum*	France
	Urin. bladder	*Sphaerospora elegans*	Germany
Phycis blennioides Br.	Urin. bladder	*Zschokkella hildae*	Norway
P. mediterraneus (*P. phycis* L.)	Gall-bladder	*Leptotheca polymorpha*	France
Pimelodus sebae Cuv. et Val.	Membrane lining branchial cavity	*Henneguya linearis*	S. America
Pimephales notatus Raf.	Gall-bladder	*Myxobolus notatus*	Canada
Piramutana blochi C. et V.	?	*inaequalis*	S. America
Platystoma fasciatum L.	Branchiae	*Henneguya linearis*	"
Pleuronectes flesus L.	Gall-bladder	? *Ceratomyxa drepanopsettae*	Norway
P. platessa L.	"	"	"
	Otic-capsule	*Sphaerospora platessae*	England
Pomolobus aestivalis	Muscle	*Chloromyxum clupeidae*	U. S. A.
P. mediocris Mitch.	"	*clupeidae*	"
P. pseudoharengus Young.	"	*clupeidae*	"
Pseudopleuronectes americanus	Gall-bladder	*Ceratomyxa acadiensis*	Canada
	"	*Myxidium* sp.	"
	Subcutaneous muscl. tissue	*Myxobolus pleuronectidae*	U. S. A.
Pteroplatea maclura Le Sueur	Gall-bladder	*Chloromyxum leydigi*	"
	"	*Leptotheca scissura*	"
Raja asterias	"	*Myxidium giganteum*	Italy
R. batis L.	"	*Chloromyxum leydigi*	France
	Gall-duct	*Myxidium* sp.	Germany ?
R. radiata	Gall-bladder	*Chloromyxum* sp.	Murman Coast
R. clavata L.	"	*Chloromyxum leydigi*	France
R. undulata Lac.	"	*Chloromyxum leydigi*	"
Rhina squatina L.	"	*Chloromyxum leydigi*	France, Germany
Rhinobathus sp. (?) Awer.	"	*Ceratomyxa* sp. (?)	Africa
Rhodeus amarus Bl.	Branchiae	*Myxobolus cycloides*	Germany
Salmo fontinalis Mitch.	Cartilage, perichondrium	*Lentospora cerebralis*	"
Scardinius erythrophthalmus	Branchiae	*Myxobolus cycloides*	"
	"	*scardinii*	Russia
	"	*Myxosoma dujardini*	France, Germany
	Gall-bladder	*Myxidium macrocapsulare*	"
	Muscle, spleen	*Myxobolus dispar*	France
	Air-bladder	*permagnus*	Germany
	"	*physophilus*	Russia
Scatophagus argus	Gall-bladder	*Ceratomyxa* sp. (?)	Africa

Host	Organ Infected	Myxosporidian	Locality
Scoliodon terrae-novae	Gall-bladder	*Ceratomyxa abbreviata*	U. S. A.
	"	*attenuata*	"
	"	*sphairophora*	"
	"	*taenia*	"
	"	*Chloromyxum leydigi*	"
Scomber scombrus L.	"	*Leptotheca parva*	France, Norway
	Kidney	*renicola*	France
	?	Gen. et sp. inc.	Germany?
Scorpaena porcus L.	Gall-bladder	*Ceratomyxa arcuata*	France
S. scrofa L.	"	*Ceratomyxa arcuata*	"
	"	*Myxidium incurvatum*	"
S. sp.	"	*Leptotheca agilis*	", Germany
Scyllium canicula	"	*Ceratomyxa sphaerulosa*	Monaco
	"	*Chloromyxum leydigi*	", France Germany
S. asterias	"	"	Italy
Sebastes dactylopterus	"	*Leptotheca macrospora*	Norway
S. norvegicus	"	*Leptotheca* sp.	Eastern Finmark
S. viviparus H. Kr.	"	*Leptotheca macrospora*	Norway
Siphonostoma rondeletii	"	*Sphaeromyxa sabrazesi*	Monaco
Siphostoma floridae	"	*balbianii*	U. S. A.
	Urin. bladder	*Sinuolinea arborescens*	"
S. louisianae	Gall-bladder	*Sphaeromyxa balbianii*	"
Solea vulgaris	"	*Myxidium gadi*	France
Sparus berda	"	*Ceratomyxa* (?) *spari*	Africa
Sphaeroides maculatus	Urin. bladder	*navicularia*	U. S. A.
	"	*Sinuolinea capsularis*	"
	"	*Zschokkella globulosa*	"
Spinax spinax L.	Gall-bladder	*Chloromyxum leydigi*	Italy, France
Squalis agassizii Heck.	Branchiae	*Myxobolus mülleri*	France
S. a. Savigny Bonaparte	"	*Myxobolus mülleri*	"
Stenotomus chrysops L.	Muscle	*Chloromyxum clupeidae*	U. S. A.
Stizostedion vitreum Mitch.	Urin. bladder	Gen. et sp. incert.	Canada
Syngnathus acus L.	Gall-bladder	*Myxidium incurvatum*	France
	"	*Sphaeromyxa sabrazesi*	Italy, Monaco
	Muscle	*Chloromyxum quadratum*	France
S. typhle	Gall-bladder	*Myxidium incurvatum*	France
Synodontis schall Bl. Schn.	Integum. of cephalic reg.	*Henneguya strongylura*	Egypt
	?	*Myxobolus inaequalis*	S. America
Synodus faetans	Gall-bladder	*Ceratomyxa agglomerata*	U. S. A.
	"	*amorpha*	"
Tautogolabrus adspersus Walb.	Muscle	*Chloromyxum clupeidae*	"

Host	Organ Infected	Myxosporidian	Locality
Thymallus thymallus L.	Gall-bladder	*Chloromyxum thymalli*	Austria
	"	*Myxobolus* sp.	"
	Neurilemma (?)	*pfeifferi*	Germany ?
Thysanophris japonicus	Gall-bladder	*Sphaeromyxa exneri*	Africa
Tinca tinca L. (*T. vulgaris*)	Branchiae	*Myxobolus piriformis*	France, Germany
	Air-bladder, kidney, etc.	*ellipsoides*	"
	Gall-bladder	*Chloromyxum cristatum*	France
	"	*Myxidium pfeifferi*	Germany
	Kidney	*Myxobolus cyprini*	Germany, Hungary
Torpedo narce Risso	Gall-bladder	*Chloromyxum leydigi*	France
T. ocellata	"	*Chloromyxum leydigi*	Germany
T. torpedo L.	"	*Chloromyxum leydigi*	"
Trachinus draco L.	"	*Ceratomyxa reticularis*	"
	"	*Myxidium incurvatum*	"
Trachurus trachurus L.	Muscle	*Chloromyxum quadratum*	France, Germany
Trutta fario L.	Gall-bladder, Gall-duct	*Chloromyxum truttae*	France
	Nervous syst.	*Myxobolus neurobius*	Germany
	Subcutaneous conn. tiss. at base of fin	*Henneguya nüsslini*	"
T. iridea Gibb.	Cartilage, perichondrium	*Lentospora cerebralis*	"
T. salar L.	"	"	"
	Gall-bladder	*Myxidium oviforme*	Norway
Trygon pastinaca L.	Gall-bladder	*Chloromyxum leydigi*	France
	"	*Leptotheca agilis*	" , Italy
Tylosurus marianus	Urin. bladder	*Chloromyxum granulosum*	U. S. A.
T. schismatorhynchus	Gall-bladder	*Ceratomyxa tylosuri*	Africa
Urophycis chuss	"	*acadiensis*	Canada
Zoarces angularis	"	*acadiensis*	"
Amphibia			
Bufo lentiginosus	Kidney	*Wardia ohlmacheri*	U. S. A.
B. marinus L.	Gall-bladder	*Sphaeromyxa immersa*	Brazil
Hyla aurea	Testis, ovary	*Myxobolus hylae*	Australia
Leptodactylus ocellatus	Gall-bladder	*Sphaeromyxa immersa*	Brazil
Molge cristata Laur. (*Triton* c.)	"	*Chloromyxum caudatum*	France
Proteus anguineus L.	Kidney	*Chloromyxum protei*	Austria
Rana esculenta	"	?*Wardia ohlmacheri*	France ?
R. temporaria (*R. fusca*)	"	?*Wardia ohlmacheri*	"
Reptilia			
Emys orbicularis L. (*Cistudo europaea*)	Kidney	*Myxidium danilewskyi*	Russia, France

Host	Organ Infected	Myxosporidian	Locality
Lacerta sp.	Ovarian egg	Gen. et spec. incert.	Italy
Trionyx (*Amyda*) *ganzeticus*	Kidney	*Myxidium mackiei*	India
T. spinifera	"	*americanum*	U. S. A.

C. DISTRIBUTION OF MYXOSPORIDIA IN THE ORGANS OF THE HOST

Altho some species are found in various organs of the host animal, the majority has one or two particular seats of infection. Among the various organs which become infected, the gall-bladder is most frequently infected. The kidney, branchia and urinary bladder have less chances of being parasitized. As to the infection of the reproductive organs of the host, little is known. The male reproductive organ becomes rarely infected, being reported only twice. The female reproductive organ, however, is more frequently infected. The infection of the next generation of the host animal thru the infected ovum which is known to occur in some Microsporidian parasites, has not been reported in Myxosporidia as yet.

LIST IV. ORGANS OF HOST INFECTED BY MYXOSPORIDIA

I. Pisces

1) Integument.—*Sphaerospora* sp. Southwell et Prashad (under the scales)
Myxobolus seni Southwell et Prashad (fin)
Myxobolus transovalis Gurley (under the scales)
Myxobolus unicapsulatus Gurley (head)
Myxobolus cycloides Gurley (opercle)
Myxobolus inaequalis Gurley (head)
Myxobolus sp. Gurley (opercle, head, fin)
Myxobolus squamae Keysselitz (inner surface of the scales)
Myxobolus volgensis Reuss (fin)
Myxobolus permagnus Wegener (operculum)
Myxobolus aureatus Ward (fin)
Henneguya brachyura Ward (fin-ray)
Henneguya linearis (Gurley) Labbé (membrane lining branchial cavity)
Henneguya gurleyi Kudo (base of spines of dorsal fin)
Henneguya strongylura (Gurley) Labbé (cephalic region)
Lentospora dermatobia Ishii

2) Connective tissue.—*Myxidium anguillae* Ishii (subcutaneous)
Myxobolus fuhrmanni Auerbach (under the oral mucous membrane)
Myxobolus oviformis Thélohan (subcutaneous)
Myxobolus lintoni Gurley (subcutaneous)
Myxobolus oblongus Gurley (chiefly of the head)
Myxobolus gigas Auerbach (of operculum, sides and fins)
Myxobolus capsulatus Davis (visceral)
Henneguya kolesnikovi (Gurley) Labbé (interstitial)
Henneguya nüsslini Schuberg et Schröder (at the base of dorsal fin)
Henneguya miyairii Kudo (of the head)
Gen. et sp. incert. Linton (subcutaneous)

3) Muscle.—*Leptotheca perlata* (Gurley) Labbé
Chloromyxum quadratum Thélohan
Chloromyxum funduli Hahn
Chloromyxum clupeidae Hahn
Lentospora multiplicata Reuss
Myxobolus notatus Mavor (connective tissue of voluntary muscle)
Myxobolus pfeifferi Thélohan
Myxobolus sandrae Reuss
Myxobolus musculi Keysselitz
Myxobolus funduli Kudo
Myxobolus pleuronectidae Hahn
Myxobolus sp. Southwell (subcutaneous intermuscular tissue)
Myxobolus nodularis Southwell et Prashad
Myxobolus orbiculatus Kudo
Henneguya creplini (Gurley) Labbé
Henneguya monura (Gurley) Labbé
Henneguya zschokkei (Gurley) Doflein
Henneguya salminicola Ward
Gen. et spec. incert. Leydig

4) Eye.—*Sphaerospora platessae* Woodcock (optic capsule)
Myxobolus oculi-leucisci Trojan (vitreous body)
Myxobolus ellipsoides Thélohan
Myxobolus mülleri Bütschli
Myxobolus aeglefini Auerbach
Myxobolus volgensis Reuss
Myxobolus magnus Awerinzew
Henneguya schizura (Gurley) Labbé (intercellular tissue of eye muscle)

5) Branchiae.—*Sphaerospora carassii* Kudo
Myxosoma dujardini Thélohan
Myxosoma (?) *lobatum* Nemeczek
Myxosoma funduli Kudo
Lentospora acuta (Fujita)
Myxobolus piriformis Thélohan
Myxobolus toyamai Kudo
Myxobolus rohitae Southwell et Prashad
Myxobolus dispar Thélohan
Myxobolus ellipsoides Thélohan
Myxobolus exiguus Thélohan
Myxobolus oviformis Thélohan
Myxobolus mülleri Bütschli
Myxobolus globosus Gurley
Myxobolus cycloides Gurley (also pseudobranchiae)
Myxobolus sphaeralis Gurley
Myxobolus anurus Cohn
Myxobolus sp. Gurley
Myxobolus gigas Auerbach
Myxobolus volgensis Reuss
Myxobolus scardinii Reuss
Myxobolus macrocapsularis Reuss
Myxobolus bramae Reuss
Myxobolus cyprinicola Reuss

Myxobolus balleri Reuss
Myxobolus sp. Miyairi
Myxobolus sp. Wegener
Myxobolus permagnus Wegener
Myxobolus rotundus Nemeczek
Myxobolus minutus Nemeczek
Myxobolus funduli Kudo
Myxobolus koi Kudo
Myxobolus discrepans Kudo
Henneguya psorospermica Thélohan
Henneguya texta (Cohn)
Henneguya minuta (Cohn)
Henneguya lobosa (Cohn)
Henneguya creplini (Gurley) Labbé
Henneguya linearis (Gurley) Labbé
Henneguya acerinae Schröder
Henneguya gigantea Nemeczek
Gen. et spec. incert. Heckel et Kner

6) Heart.—*Myxobolus cordis* Keysselitz (muscle of ventricle and bulbus arteriosus)
Gen. et spec. incert. Leydig (auriculo-ventricular valve)

7) Air bladder.—*Myxobolus ellipsoides* Thélohan (conn. tiss.)
Myxobolus mülleri Bütschli (conn. tiss.)
Myxobolus physophilus Reuss (surface)
Myxobolus permagnus Wegener

8) Body-cavity (cyst).—*Myxobolus* sp. Gurley
Myxobolus carassii Klokacewa
Gen. et spec. incert. Leydig

9) Nervous tissue.—*Myxobolus neurobius* Schuberg et Schröder
Lentospora encephalina Mulsow (blood vessel of brain)

10) Bone, cartilage, perichondrium.—*Lentospora cerebralis* (Hofer) Plehn
Myxobolus aeglegini Auerbach
Henneguya brachyura Ward (of fin)

11) Stomach, pyloric cecum.—*Myxobolus exiguus* Thélohan
Myxobolus mesentericus Kudo
Henneguya tenuis Vaney et Conte

12) Liver.—*Myxobolus ellipsoides* Thélohan
Myxobolus oviformis Thélohan
Myxobolus cyprini Doflein
Myxobolus cordis Keysselitz
Myxobolus musculi Keysselitz
Myxobolus carassii Klokacewa
Myxobolus mesentericus Kudo

13) Gall-bladder.—*Leptotheca agilis* Thélohan
Leptotheca elongata Thélohan
Leptotheca polymorpha (Thélohan) Labbé
Leptotheca parva Thélohan
Leptotheca hepseti Thélohan
Leptotheca sp. Awerinzew
Leptotheca macrospora Auerbach
Leptotheca informis Auerbach
Leptotheca longipes Auerbach

Leptotheca fusiformis Davis
Leptotheca scissura Davis
Ceratomyxa arcuata Thélohan
Ceratomyxa sphaerulosa Thélohan
Ceratomyxa pallida Thélohan
Ceratomyxa globurifera Thélohan
Ceratomyxa appendiculata Thélohan
Ceratomyxa truncata Thélohan
Ceratomyxa reticularis Thélohan
Ceratomyxa inaequalis Doflein
Ceratomyxa linospora Doflein
Ceratomyxa ramosa Awerinzew
Ceratomyxa drepanopsettae Awerinzew
Ceratomyxa tylosuri Awerinzew
Ceratomyxa (?) *spari* Awerinzew
Ceratomyxa sp. (?). Awerinzew
Ceratomyxa sp (?). Awerinzew
Ceratomyxa acadiensis Mavor
Ceratomyxa sp. Georgévitch
Ceratomyxa coris Georgévitch
Ceratomyxa herouardi Georgévitch
Ceratomyxa mesospora Davis
Ceratomyxa sphairophora Davis
Ceratomyxa taenia Davis
Ceratomyxa attenuata Davis
Ceratomyxa recurvata Davis
Ceratomyxa lunata Davis
Ceratomyxa abbreviata Davis
Ceratomyxa flagellifera Davis
Ceratomyxa agglomerata Davis
Ceratomyxa amorpha Davis
Ceratomyxa monospora Davis
Ceratomyxa streptospora Davis
Ceratomyxa aggregata Davis
Ceratomyxa undulata Davis
Chloromyxum leydigi Mingazzini
Chloromyxum fluviatile Thélohan
Chloromyxum truttae Léger (also gall-duct)
Chloromyxum cristatum Léger
Chloromyxum dubium Auerbach
Chloromyxum sp. Awerinzew
Chloromyxum thymalli Lebzelter
Chloromyxum koi Fujita
Chloromyxum magnum Awerinzew
Chloromyxum misgurni Kudo
Chloromyxum fujitai Kudo
Chloromyxum trijugum Kudo
Chloromyxum catostomi Kudo
Chloromyxum wardi Kudo
Sphaerospora masovica Cohn
Myxidium incurvatum Thélohan
Myxidium sphaericum Thélohan

Myxidium sp. Gurley (only in gall-duct)
Myxidium giganteum Doflein
Myxidium pfeifferi Auerbach
Myxidium inflatum Auerbach
Myxidium bergense Auerbach
Myxidium procerum Auerbach
Myxidium macrocapsulare Auerbach
Myxidium sp. Awerinzew
Myxidium oviforme Parisi
Myxidium sp. Mavor
Myxidium kagayamai Kudo
Myxidium gadi Georgévitch
Myxidium glutinosum Davis
Myxidium phyllium Davis
Myxidium striatum Cunha et Fonseca
Myxobolus misgurni Kudo (few spores only)
Myxobolus sp. Lebzelter (spores only)
Sphaeromyxa balbianii Thélohan
Sphaeromyxa incurvata Doflein
Sphaeromyxa sabrazesi Laveran et Mesnil
Sphaeromyxa hellandi Auerbach
Sphaeromyxa exneri Awerinzew
Sphaeromyxa gasterostei Georgévitch
Zschokkella nova Klokacewa
Zschokkella acheilognathi Kudo (also in gall-duct)
Gen. incert. *congri* Perugia
Gen. incer. *merlucii* Perugia
Gen. et spec. incert. Mavor

14) Spleen.—*Myxobolus piriformis* Thélohan
Myxobolus sp. Kudo
Myxobolus ellipsoides Thélohan
Myxobolus exiguus Thélohan
Myxobolus oviformis Thélohan
Myxobolus pfeifferi Thélohan
Myxobolus cyprini Doflein
Myxobolus cordis Keysselitz
Myxobolus musculi Keysselitz
Myxobolus mesentericus Kudo

15) Intestine.—*Myxobolus exiguus* Thélohan
Myxobolus mülleri Bütschli
Myxobolus pfeifferi Thélohan
Myxobolus miyairii Kudo
Myxobolus carassii Klokaçewa
Myxobolus mesentericus Kudo
Henneguya peri-intestinalis Cépède
Henneguya tenuis Vaney et Conte

16) Ovary.—*Wardia ovinocua* Kudo
Sphaerospora elegans Thélohan
Myxidium histophilum Thélohan
Myxobolus pfeifferi Thélohan
Myxobolus mülleri Bütschli
Myxobolus musculi Keysselitz

Henneguya oviperda (Cohn)
Henneguya media Thélohan
Henneguya brevis Thélohan

17) Kidney.—a) Urinary tubules.—*Leptotheca renicola* Thélohan
Mitraspora caudata (Parisi) Kudo
Mitraspora cyprini Fujita (also in ureter)
Mitraspora elongata Kudo
Sphaerospora elegans Thélohan
Sphaerospora divergens Thélohan
Henneguya media Thélohan
Henneguya brevis Thélohan
Henneguya gasterostei Parisi
Hoferellus cyprini Doflein

b) Tissue.—*Mitraspora elongata* Kudo
Chloromyxum quadratum Thélohan
Sphaerospora rostrata Thélohan (Malpighian bodies)
Myxidium histophilum Thélohan
Lentospora asymmetrica Parisi
Myxobolus pfeifferi Thélohan
Myxobolus cyprini Doflein
Henneguya neapolitana Parisi (conn. tiss. of ren. tubules)
Hoferellus cyprini Doflein

c) Seat, unstated.—*Chloromyxum mucronatum* Gurley
Sphaerospora angulata Fujita
Myxidium barbatulae Cépède
Myxidium giardi Cépède
Myxobolus piriformis Thélohan
Myxobolus ellipsoides Thélohan
Myxobolus exiguus Thélohan
Myxobolus oviformis Thélohan
Myxobolus mülleri Bütschli
Myxobolus obesus Gurley
Myxobolus cycloides Gurley
Myxobolus cordis Keysselitz
Myxobolus musculi Keysselitz

18) Urinary bladder.—*Leptotheca lobosa* Davis
Leptotheca glomerosa Davis
Ceratomyxa navicularia Davis
Ceratomyxa spinosa Davis
Chloromyxum mucronatum Gurley
Chloromyxum granulosum Davis
Sphaerospora elegans Thélohan
Sphaerospora divergens Thélohan
Sphaerospora polymorpha Davis
Sphaerospora sp. Davis
Sinuolinea dimorpha Davis (also in ureter)
Sinuolinea capsularis Davis
Sinuolinea arborescens Davis
Sinuolinea opacita Davis
Sinuolinea brachiophora Davis
Myxidium lieberkühni Bütschli
Zschokkella hildae Auerbach
Zschokkella globulosa Davis

Myxoproteus ambiguus (Thélohan) Doflein
Myxoproteus cordiformis Davis
Myxoproteus cornutus Davis
Henneguya legeri Cépède
Henneguya wisconsinensis Mavor et Strasser
Henneguya mictospora Kudo
Gen. et spec. incert. Mavor

19) Testis.—*Myxobolus pfeifferi* Thélohan (only spores)
20) Mesentery.—*Myxobolus mesentericus* Kudo
21) Seat unknown.—*Henneguya* sp. Gurley (integument?)
Gen. et. spec. incert. Borne

II Amphibia

1) Gall-bladder.—*Chloromyxum caudatum* Thélohan
Sphaeromyxa immersa (Lutz) Thélohan
2) Urinary tubules of kidney.—*Wardia ohlmacheri* (Gurley) Kudo
Chloromyxum protei Joseph

TABLE I

	Integument	Conn. tissue	Muscle	Eye	Gill	Heart	Air-bladd.	Nerv. tiss.	Bone, cartilage	Stomach wall	Liver	Gall-bladd.	Spleen	Intestine wall	Testis	Ovary	Kidney	Body cavit.	Urinary bladder	Mesentery	Seat unknown
Leptotheca			1									11					1(a)*		2		
Ceratomyxa												33							2		
Myxoproteus																			3		
Wardia																1	1(a)				
Mitraspora																	3(a) 1(b)*				
Chloromyxum			3									14					1(a) 1(b) 1(c)*	1	2		
Sphaerospora	1			1	1							1				1	2(a) 1(b) 1(c)		4		
Sinuolinea																	2(a)		5		
Myxidium		1										18				1	1(b) 2(c) 3(a)		1		
Sphaeromyxa												7									
Zschokkella												2							2		
Myxosoma					3																
Lentospora	1		1		1			1	1								1(b)	1			
Myxobolus	10	6	9	6	28	1	4	1	1	2	7	2	10	6	2	4	2(b) 9(c)	1		1	1
Henneguya	4	3	4	1	8				1	1				2		3	3(a) 1(b)		3		1
Hoferellus																	1(a) 1(b)				
Total	16	10	18	8	41	1	4	2	3	3	7	88	10	8	2	10	39	3	24	1	2

* For (a), (b) and (c), see page 42.

3) Testis, oviduct.—*Myxobolus hylae* Johnston et Bancroft

III Reptilia

1) Kidney (ren. tub.).—*Myxidium danilewskyi* Laveran
Myxidium mackiei Bosanquet
Myxidium americanum Kudo

2) Ovary.—Gen. et spec. incert. Mingazzini

IV Insecta

1) Abdominal cavity.—*Chloromyxum diploxys* Gurley

V Annelida

Myxobolus sp. Gurley

The data in this section are summarized on the preceding page (Table I).

D. THE EFFECT OF ENVIRONMENT ON THE ORGANAL DISTRIBUTION OF MYXOSPORIDIA IN HOSTS

Myxosporidia are almost equally distributed among marine and fresh-water fishes in regard to the number of species. This is shown in the following table.

TABLE II

Genus	Number of species found in marine fish	Number of species found in fresh-water fish	Other hosts			
			Rept.	Amph.	Insect	Annelida
Leptotheca (15)*	15	....	....	....	....	....
Ceratomyxa (35)	35	....	....	....	....	....
Myxoproteus (3)	3	....	....	....	....	....
Wardia (2)	....	1	....	1	....	....
Mitraspora (3)	....	3	....	....	....	....
Chloromyxum (22)	7	12	....	2	1	....
Sphaerospora (10)	5	5	....	....	....	....
Sinuolinea (5)	5	....	....	....	....	....
Myxidium (26)	17 (2 common)	8 (2 common)	3	....	....	....
Sphaeromyxa (7)	6	....	....	1	....	....
Zschokkella (4)	2	2	....	....	....	....
Myxosoma (3)	1	2	....	....	....	....
Lentospora (6)	2 (2 common)	6 (2 common)	....	....	....	....
Myxobolus (63)	5	56	....	1	....	1
Henneguya (32)	1	31	....	....	....	....
Hoferellus (1)	....	1	....	....	....	....
Gen. et spec. incert (12)	4	7	1	....	....	....
Total 237+12	104+4	134+7	4	5	1	1

* The number in parenthesis denotes the number of species in the corresponding genus.

These genera have certain relations to the organal distribution in the body of the host, which are shown in List IV (page 37) and Table I (on page 43) and which can be put together as follows:

TABLE III

Genus	Number of species found in body-cavity	Number of species found in tissue	Number of species found in both	Seat unknown
Leptotheca (15)	14	1	..	..
Ceratomyxa (35)	35	..	..	..
Myxoproteus (3)	3	..	..	..
Wardia (2)	1	1	..	..
Mitraspora (3)	2	..	1	..
Chloromyxum (22)	18	4	..	..
Sphaerospora (10)	4	4	1	1
Sinuolinea (5)	5	..	..	..
Myxidium (26)	22	4	..	..
Sphaeromyxa (7)	6	..	..	1
Zschokkella (4)	4	..	..	..
Myxosoma (3)	..	3	..	..
Lentospora (6)	1	5	..	..
Myxobolus (63)	2	59	..	2
Henneguya (32)	4	28	..	..
Hoferellus (1)	..	..	1	..
Gen. et spec. inct (12)	4	5	..	3
TOTAL 237+12	121+4	109+5	3	4+3

From the facts shown in the above tables, the following conclusions can be drawn.

1) The genera Leptotheca (one species in tissue), Ceratomyxa, Myxoproteus, Sinuolinea and Sphaeromyxa (one species in Amphibia) include parasites from the body cavity of marine fish.

2) The majority of the genera Lentospora, Myxosoma, Myxobolus (one species in Amphibia), Henneguya and Hoferellus include parasites in tissues of fresh-water fish.

3) The genera Chloromyxum, Sphaerospora, Myxidium and Zschokkella include forms that infect the body-cavity as well as the tissue of marine and fresh-water fishes.

4) The genus Mitraspora includes three species that parasitize the fresh-water fish.

5) The genus Myxidium has three species found in the kidney of reptiles.

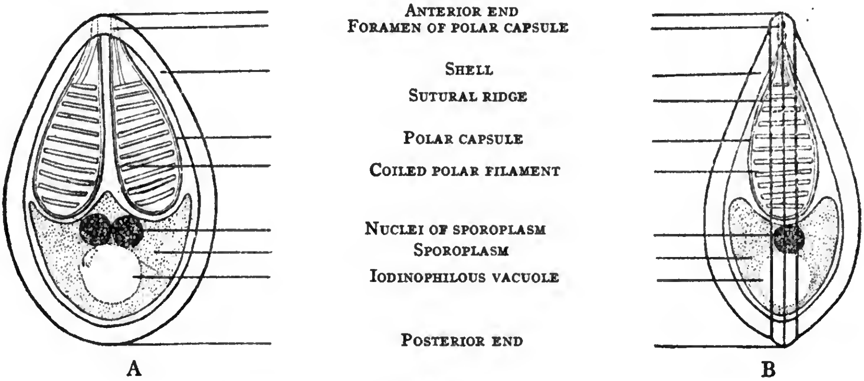
6) The genera Wardia, Chloromyxum, Sphaeromyxa and Myxobolus include species parasitic in Amphibia.

7) The genus Chloromyxum has one species found in an insect.

8) The genus Myxobolus has one species found in an annelid, which was not normally recorded.

THE SPORE

As will be shown later (page 52–55), the spore stage is still the only constant character by which various forms of Myxosporidia are identified from each other. For this reason it is necessary to have a clear conception of the form and structure of the spore and at the same time to define the terms used in the present paper, even tho they have commonly been used heretofore.



Textfigure

Diagrammatical front [A] and side [B] views of a Myxobolus spore.

(For further explanation see following pages.)

The spore of Myxosporidia is covered by a shell, which is composed of two valves, usually symmetrical in form and size, that come in contact in the sutural plane. The sutural line is straight in most cases, tho sometimes curved like an S. It is more or less thickened, forming the sutural ridge. The sutural ridge is to be made out clearly in fresh as well as in stained preparations and furnishes important data in regard to the classification of the parasite. The thickness of the shell-valve is usually uniform; in some species (Myxobolus), however, it may differ slightly in different parts of the shell. Besides, in many species of Myxobolus, the shell differentiates a small triangular intercapsular appendix on the inside at the anterior end directed posteriad between two polar capsules.

The form of the spore varies greatly owing to the shape of the shell together with its variously developed appendages; 1) lateral appendages as in Ceratomyxa, 2) anterior processes as in Myxoproteus, 3) posterior processes as in Wardia (fringe-like), Mitraspora (filiform), Hoferellus (spinous), Henneguya (tail-form), etc.

The surface of the shell may be smooth or exhibit various markings. More or less conspicuous ridges varying in form and number in different species, may run parallel to the sutural line, may show a network-like structure or may exhibit short tooth-like processes arising from the sutural ridge and radiating toward the center of each valve. When the ridges are fine, they form delicate striations, arranged usually parallel to the sutural line. Tho these markings are usually easily seen in vivo, they are very often more readily studied in stained preparations.

Inside of the shell are present the polar capsules and sporoplasm. Gurley (1894:120) and Davis (1917:210) used the term "capsules" instead of polar capsules because of the facts that "the situation implied by the the latter (polar capsule) is not constant" (Gurley) and that "they are often not in the position indicated by the term polar capsule" (Davis). The present writer, however, does not agree with these authors and retains the commonly used term, polar capsule, thruout the present paper on the basis of the fact that these polar capsules are situated at or near the more or less attenuated anterior end in the great majority of species or at each end (in Myxidiidae) of the spore, except in the few cases as in Wardia in which they are situated in the central portion and have the foramina at the anterior end of the spore.

The polar capsules may be pyriform or spherical. They are located at or near one end (anterior end) of the spore. In Myxidiidae, one polar capsule is situated at each end, in which case no distinction can be made between the anterior and posterior ends. The end or side opposite to the anterior, is the posterior end of the spore. The number of polar capsules in a spore varies according to the different genera. There is only one polar capsule in the spore of unicapsular Myxobolus, four in Chloromyxum, two in all the other genera. They may be equal or unequal in form and size. When two polar capsules are located at the anterior end, they may be convergent or divergent. Each has a foramen to the outside of the spore thru the shell in or near the sutural line, thru which the polar filament is extruded. The foramen is observable in the fresh condition. Staining will very often show clearly the canals thru the shell. Each polar capsule has an independent foramen.

In the polar capsule exists a coiled polar filament, which in most cases can be recognized without difficulty in the fresh condition. The polar filament is as a rule a more or less extended, probably hollow thread connected with the polar capsule, which is extruded from the spore thru the foramen under the action of the stimulants such as the digestive fluid of the host or certain chemicals. In Sphaeromyxa it is rather short and thick, tapering to a point. The polar filament is coiled around the longest axis of the polar capsule, except in Sphaeromyxa in which it is coiled around an axis perpendicular to the longest axis of the polar capsule.

The sporoplasm occupies the extracapsular cavity at the posterior region of the spore. It is of granular structure with almost always two nuclei. Besides, it has an iodinophilous vacuole mostly round or oval in the spores of the family Myxobolidae. It occurs thruout the spore stage and is the important character of the said family. The contents of the vacuole is probably of glycogenous nature and is stained deeply with iodine. Small refringent fat globules have also been observed in the spore.

Davis (1917:212) proposed to use capsular and postcapsular sides in place of anterior and posterior ends which have most frequently been used and are also used in the present paper. The latter terms can be employed as properly as Davis' terms except in the case of the Myxidiidae, where both terms, strictly speaking, are inapplicable.

Tho various abnormal spores are very often encountered in several species, the majority of the spores are of typical form, structure and size. In Myxosoma and Myxobolus, the spore sometimes develops a short posterior process, which is highly developed in the spore of the genus Henneguya.

Young spores, generally speaking, are more rounded in form than the mature form, while the mature spores, as a rule, are of definite form, structure and size characteristic to the species. It should, however, be kept in mind that there is a certain amount of variation among these characters.

As is generally recognized, one must mention whether the spores were measured in fresh condition or in fixed and stained state. The fresh spore is generally more or less larger than the mounted one.

DEFINITION OF TERMS USED FOR DESCRIPTIONS

Anterior end.—The end of the spore where the polar capsules open; in most cases the polar capsules are situated at this end.

Anterior process.—The spinous process of the shell at the anterior end of the spore of the genus Myxoproteus.

Breadth.—The larger diameter of the spore measured at right angles to the length or sutural diameter; the shorter diameter thus measured being the thickness.

Capsulogenous cell.—A small island of protoplasm with a nucleus, in which polar capsule becomes differentiated.

Cyst.—The vegetative form of more or less conspicuous size in tissues of the host, surrounded usually by a membranous structure composed of the host issue.

Disporous.—The character of a trophozoite of forming only two spores.

Foramen.—Opening of the polar capsule thru which the polar filament is extruded.

Front view.—The view in which length and breadth of the spore are laid horizontally.

Gemmules.—A small mass of trophozoite separated from the mother body by plasmotomy. Used by Davis (1917). (See page 105.)

Iodinophilous vacuole.—The vacuole in the sporoplasm of the spore of the family Myxobolidae, the contents of which are stained brownish with iodine.

Lateral process.—The lateral prolongation of the shell-valve at right angles to the sutural plane.

Length.—Antero-posterior diameter of the spore in the sutural plane; equivalent to sutural diameter.

Longitudinal striations.—Fine ridges or thickenings marked longitudinally on the shell of the spore.

Mesoplasm.—An intermediate layer between ectoplasm and endoplasm, coined by Cohn in the case of *Myxidium lieberkühni* (see page 107).

Mictosporous.—The character of the trophozoite of forming a variable number of spores in an individual.

Monosporous.—The character of the trophozoite of forming a single spore.

Pansporoblast.—Coined by Gurley (1893:408) used here in the same meaning, an enclosed area in the endoplasm of the vegetative form, in which two sporoblasts become differentiated.

Plasmogamy. Fusion of two trophozoites, coined by Doflein (1898).

Plasmotomy.—Division of trophozoite into daughter individuals, coined by Doflein (1898).

Polar capsule.—The pyriform or spherical, hollow body in the spore which forms a polar filament.

Polar filament.—The filament which is coiled inside the polar capsule.

Polysporous.—The character of the trophozoite of forming spores, more than two.

Posterior filament.—Fine posterior appendage of the spore.

Posterior processes.—Posterior differentiations of the shell.

Ridge.—Linear or network-like elevation of the shell of the spore.

Shell.—The envelope of the spore.

Shell-valves.—Two valves which compose the shell of the spore.

Sporoplasm.—The protoplasmic mass found inside of the spore (amebula or sporozoite), usually situated in the posterior portion of the spore.

Sutural diameter.—Same as length.

Sutural edge.—The edge of the shell-valves cut by the sutural plane.

Sutural line.—The line on the shell of the spore marked by the sutural plane.

Sutural plane.—The plane on which two shell-valves meet together.

Sutural ridge.—The ridge marking the sutural line.

Tail.—The posterior prolongation of the valves from the median posterior end; it may be a single process or bifurcated.

Thickness.—See breadth.

Trophozoite.—The vegetative or multiplicative stage of a Myxosporidian.

Vegetative form.—Same as trophozoite.

CLASSIFICATION OF MYXOSPORIDIA

The classification of Myxosporidia, was first carried out by Thélohan as early as 1892, who considered rightly that the spore was the only reliable means for the purpose. In 1899 and 1901, Doflein introduced into the classification two Legions, Disporea and Polysporea, and a new family. This plan has generally been followed by various authors in dealing with these protozoa.*

The classification of the said author, however, no longer agrees with our present knowledge of the animals. In the first place, as was pointed out by some authors, for instance Davis (1917:217), it is far from being correct to divide the Myxosporidia into two Legions, Disporea and Polysporea, on the basis of the number of spores formed in each vegetative form, since this differs even in one and the same species as was observed by Léger, Auerbach, Awerinzew, Parisi, Georgévitch, Davis, Kudo and others (see Table IV on page 53).

Auerbach who had observed numerous interesting facts in this group, had adopted Doflein's classification in his splendid work (1910) by simply adding two genera, Zschokkella and Lentospora, to the family Myxidiidae. In the following year (1911), he tried a new classification, on the same basis as Doflein did, by introducing two new Legions besides these two already existing, and by discarding all the families. Thus:

I Monosporea	a) Genus	Coccomyxa
II Mictosporea	a) Genus	Zschokkella
	b) Genus	Myxoproteus
	c) Genus	Myxidium
	d) Genus	Sphaeromyxa
	e) Genus	Chloromyxum
	f) Genus	Sphaerospora
III Disporea	a) Genus	Ceratomyxa
	b) Genus	Leptotheca
IV Polysporea	a) Genus	Myxosoma
	b) Genus	Lentospora
	c) Genus	Myxobolus
	d) Genus	Henneguya
	e) Genus	Hoferellus

As will be distinctly seen from Table IV, the classification not only fails to improve Doflein's classification in bringing together the genera, Myxo-

* Doflein still uses the same classification in his recent work (1916).

proteus, Myxidium and Sphaeromyxa into Mictosporea, and Lentospora and Henneguya into Polysporea, but increases the confusion concerning relationship among the genera.

TABLE IV

Genus	Mono- and di-sporous	Mono- and poly-sporous	Di-sporous	Mono-, di- and poly-sporous	Di- and poly-sporous	Poly-sporous	Unknown
Leptotheca 15 species......	..	..	8	..	..	..	7
Ceratomyxa 35 species......	3	..	23	..	4	..	5
Myxoproteus 3 species........	..	..	2	..	..	..	1
Wardia* 2 species........	..	..	..	..	..	1	1
Mitraspora* 3 species........	..	..	..	..	2	1	..
Chloromyxum 22 species......	1	2	..	2	6	4	7
Sphaerospora 10 species......	1	..	2	1	2	2	2
Sinuolinea* 5 species........	..	..	2	..	2	1	..
Myxidium 26 species......	1	..	2	2	2	9	10
Sphaeromyxa 7 species........	..	..	..	..	..	5	2
Zschokkella 4 species........	1	..	..	1	..	1	1
Myxosoma 3 species........	..	..	..	..	..	3	..
Lentospora 6 species........	..	..	2	..	..	2	2
Myxobolus 63 species......	..	..	..	..	..	54	9
Henneguya 32 species......	..	..	..	1	1	25	5
Hoferellus 1 species........	..	..	..	..	..	1	..

* These three genera are unknown to Auerbach, except two species which were formerly placed in Leptotheca and Sphaerospora.

Parisi (1912) followed Auerbach in his paper dealing with Myxosporidia from Italian waters. Poche (1913) put Auerbach's classification in better form as follows:

Order: Myxosporidia
- 2 Superfamily Mictosporea
  - 2 Family Myxidiidae
    - 2 Genus Zschokkella
    - 3 Genus Myxoproteus
    - 4 Genus Myxidium
    - 5 Genus Sphaeromyxa
    - 6 Genus Sphaerospora
  - 3 Family Chloromyxidae
    - 7 Genus Chloromyxum
- 3 Superfamily Disporea
  - 4 Family Ceratomyxidae
    - 8 Genus Ceratomyxa
    - 9 Genus Leptotheca
- 4 Superfamily Polysporea
  - 5 Family Myxosomatidae (Poche)
    - 10 Genus Myxosoma
    - 11 Genus Lentospora
  - 6 Family Myxobolidae
    - 12 Genus Myxobolus
    - 13 Genus Henneguya
    - 14 Genus Hoferellus

For the same reason given in discussing Auerbach, this, however, is not conformable with the present state of knowledge regarding these protozoa.

It was not until 1917 that the classification of the Myxosporidia approached to a more natural state in the valuable work by Davis (1917: 219–221). He pointed out sharply the unsatisfactory features in Doflein's classification and proposed a different system as follows:

Order: Myxosporidia.
- Suborder I Myxosporea Davis
  - Family 1 Ceratomyxidae
    - Genus 1 Leptotheca
    - Genus 2 Ceratomyxa
  - Family 2 Sphaerosporidae Davis
    - Genus 1 Myxoproteus
    - Genus 2 Sphaerospora
    - Genus 3 Sinuolinea
  - Family 3 Myxidiidae
    - Genus 1 Myxidium
    - Genus 2 Sphaeromyxa
    - Genus 3 Zschokkella
  - Family 4 Chloromyxidae
    - Genus 1 Chloromyxum

Suborder II Cystosporea Davis
Family 1 Myxosomidae* Davis
Genus 1 Myxosoma
Genus 2 Lentospora
Family 2 Myxobolidae
Genus 1 Myxobolus
Genus 2 Henneguya
Genus 3 Hoferellus

Thus, Davis selected the form of the spore for the establishment of two suborders and further rearranged the genera into closer positions to show relationship to each other better than any one of the previous authors. He, however, named the suborders according to a secondary character, i.e., the seat of the parasites in the host. According to his definition the trophozoites of the species belonging to Myxosporea are "with few exceptions free living in the body-cavity," while those of Cystosporea "with few exceptions" are tissue parasites.

From TABLE III on page 45, are taken the following data regarding this point:

	Total number of species known	Number of species found in body cavity	Number of species found in tissue	Number of species found in both places	Seat unknown
Myxosporea........	132	114	14	2	2
Cystosporea........	105	7	95	1	2

Thus it appears that the terms Myxosporea and Cystosporea do not seem to be properly used. These may be replaced by terms that denote the first and common character of the suborders.

The suggestions as to the adoption of other characters than the spore for the divisions of Myxosporidia, proposed by Awerinzew (1907:831; 1908:64), Auerbach (1910:161) and Davis (1917:217) can only be applied in the future. At the present time, the characters concerning the vegetative form do not appear to afford a better and more natural basis for the classification of Myxosporidia than those of the spore. Thus from the taxonomic point of view the present situation does not seem to be much improved as compared with that at the end of the last century.

The writer proposes in the following pages a new classification based on the characters of the spore.

* Davis did not notice the establishment of the family Myxosomatidae by F. Poche (1913), including exactly the same genera. See page 54.

Order MYXOSPORIDIA Bütschli 1881
Suborder EURYSPOREA nom. nov.

Largest diameter of the spore at right angles to the sutural plane. One polar capsule on each side of the plane. Sporoplasm with no iodinophilous vacuole. Vegetative form found in body cavity (except 2 species). Great majority parasites of marine fish. Monosporous, disporous and polysporous.

Family CERATOMYXIDAE Doflein 1899

With the characters of the suborder.

Genus LEPTOTHECA Thélohan 1895

Shell-valves of spore hemispherical or shortly rounded. 15 species. Disporous (7 unknown). 14 species in body-cavity; 1 in tissue; all in marine fish. Type species: *Leptotheca agilis* Thélohan.

Genus CERATOMYXA Thélohan 1892

Shell-valves, conical and hollow, attached on the bases; free ends extended, tapering to more or less sharply pointed or rounded ends. Sporoplasm usually does not fill the cavity, but is located asymmetrically in it. 35 species. Disporous (23 species), monosporous and disporous (3 species), disporous and polysporous (4 species) and unknown (5 species). All (except 2 species in urinary bladder) in the gall-bladder of marine fish. Type species: *Ceratomyxa arcuata* Thélohan.

Genus MYXOPROTEUS Doflein 1898 emend. Davis 1917

Spores roughly pyramidal; with or without distinct processes from the base of the pyramid. 3 species. Disporous (one species unknown). All in urinary bladder of marine fish. Type species: *Myxoproteus ambiguus* (Thélohan) Doflein.

Genus WARDIA nov. gen.

Spore form of isosceles triangle with two convex sides. Oval in profile. Surface of shell with fine ridges which turn into fringe-like processes at the posterior end. The polar capsules, large and perfectly spherical, situated at the central portion of the spore, opening at the anterior tip. Two species. Polysporous (one species unknown). Tissue parasite (one species) of fresh-water fish and amphibia, both found in Illinois, U. S. A. Type species: *Wardia ovinocua* nov. spec.

Genus MITRASPORA Fujita 1912 emend. Kudo

Spores spherical or ovoidal. Two polar capsules pyriform, one situated on each side of the sutural plane. Shell longitudinally striated; with or without long and fine filaments projecting posteriorly in a row at right angles to the sutural plane at the posterior side. 3 species. Disporous and polysporous. All found in kidney of fresh-water fish. Type species: *Mitraspora cyprini* Fujita.

Suborder SPHAEROSPOREA nom. nov.

Spores spherical or subspherical, with two to four polar capsules. Sporoplasm without iodinophilous vacuole. Vegetative form found in body-cavity and tissue. Monosporous, disporous and polysporous. Parasites of marine and fresh-water fish and amphibia.

Family CHLOROMYXIDAE Thélohan 1892*

Spores with four polar capsules. Monosporous, disporous and polysporous.

Genus CHLOROMYXUM Mingazzini 1890

With the characters of the family. 22 species. 18 in body cavity; 4 in tissue. 7 from marine and 12 from fresh-water fish, 2 in amphibia, 1 in insect. Type species: *Chloromyxum leydigi* Mingazzini.

Family SPHAEROSPORIDAE Davis 1917

Spores with two polar capsules. Monosporous, disporous and polysporous.

Genus SPHAEROSPORA Thélohan 1892

Spores with two polar capsules. Monosporous, disporous and polysporous. 10 species. Body-cavity and tissue. 5 from fresh-water and 5 marine fish. Type species: *Sphaerospora divergens* Thélohan.

Genus SINUOLINEA Davis 1917

Spores with or without lateral processes. Two polar capsules spherical. Sutural line sinuous. 5 species. Disporous and polysporous. In the urinary bladder of marine fish. Type species: *Sinuolinea dimorpha* Davis.

Suborder PLATYSPOREA nom. nov.

Sutural plane of the spore coincides with or at an acute angle to the longest diameter. One or two polar capsules. Sporoplasm with or without an iodinophilous vacuole.

Family MYXIDIIDAE Thélohan 1892

Two polar capsules, one at each end. Sporoplasm without any iodinophilous vacuole. Spores fusiform.

* Thélohan (1892) used the terms: Chloromyxidées, Myxididées, Myxobolidées, which Gurley (1893) made over into Chloromyxidae, Myxidiidae, Myxobolidae, so that the credit of recognizing and establishing these families belongs to Thélohan.

Genus MYXIDIUM Bütschli 1882

Spores more or less regularly fusiform, with pointed or rounded ends. Polar filaments long and fine. 26 species. Monosporous, disporous and polysporous. 22 in body-cavity; 4 in tissue. 15 in marine and 6 in fresh-water fish, 2 in fishes from both waters and 3 in reptilia. Type species: *Myxidium lieberkühni* Bütschli.

Genus SPHAEROMYXA Thélohan 1892

Spores fusiform, with truncated ends. Polar filament short and thick. Trophozoites large and disc shaped. 7 species. Polysporous (2 unknown). 6 in body-cavity; 1 unknown. 6 in marine fish; 1 in amphibia. Type species: *Sphaeromyxa balbianii* Thélohan.

Genus ZSCHOKKELLA Auerbach 1910

Spores, semicircular in front view; pointed at ends. Polar capsules large and spherical, opening on the flat edge near the tips. Sutural line usually curved in S-form. 4 species. Monosporous, disporous and polysporous. Body-cavity. 2 from marine and 2 from fresh-water fish. Type species: *Zschokkella hildae* Auerbach.

Family MYXOSOMATIDAE Poche 1913

Two polar capsules at the anterior end. Sporoplasm without iodinophilous vacuole.

Genus MYXOSOMA Thélohan 1892

Spores ovoidal, flattened and more or less elongated. 3 species. Polysporous. Tissue parasites. 2 in fresh-water and 1 in marine fish. Type species: *Myxosoma dujardini* Thélohan.

Genus LENTOSPORA Plehn 1905

Spores similar to Myxobolus in form. Sporoplasm without any iodinophilous vacuole. 6 species. Disporous and polysporous (2 unknown). 1 in marine and 3 in fresh-water fish, 2 from fishes in both waters. Type species: *Lentospora cerebralis* (Hofer) Plehn.

Family MYXOBOLIDAE Thélohan 1892

Spores with one or two polar capsules at the anterior end, with or without posterior processes. Sporoplasm with an iodinophilous vacuole. Majority polysporous in fresh-water fishes.

Genus MYXOBOLUS Bütschli 1882

Spores ovoidal or ellipsoidal; flattened. One or two polar capsules at the anterior end. Shell without posterior process. 63 species. Polysporous (9 species unknown). 59 species in tissue; 4 unknown. 5 in marine and 56 in fresh-water fish, 1 in annelid and 1 in amphibia. Type species: *Myxobolus mülleri* Bütschli.

Genus HENNEGUYA Thélohan 1892

Spores more or less globular or ovoidal. Two polar capsules at the anterior end. Posterior end of the shell-valves prolonged into more or less extended processes, which unite and form a tail in the median line. 32 species. Polysporous, disporous and monosporous. 28 species in tissue and 4 in body-cavity. In fresh-water fish, except one. Type species: *Henneguya psorospermica* Thélohan.

Genus HOFERELLUS Berg 1898

Spores pyramidal, with two posterior processes from the lateral faces. 1 species. Polysporous. Tissue and body-cavity of fresh-water fish. Type and only species: *Hoferellus cyprini* Doflein.

DESCRIPTIONS OF GENERA AND SPECIES

Suborder EURYSPOREA nom. nov.

The definition of the suborder is recorded on page 56.

Family CERATOMYXIDAE Doflein

1899	*Ceratomyxidea*	Doflein	1899 : 378
1901	*Ceratomyxidae*	Doflein	1901 : 182

The characters of the family are described on page 56.

Genus LEPTOTHECA Thélohan

1895	*Leptotheca*	Thélohan	1895 : 331

The characters of the genus are described on page 56.
Type species: *Leptotheca agilis* Thélohan.

LEPTOTHECA AGILIS Thélohan

[Figs. 1 to 5]

1892	*Ceratomyxa agilis*	Thélohan	1892 : 962
1895	*Leptotheca agilis*	Thélohan	1895 : 332
1898	*Leptotheca agilis*	Doflein	1898 : 294, 297

Habitat: Gall-bladder of *Trygon pastinaca* L. and *Scorpaeona* sp.; France, Rovigno, Napoli.

Vegetative form: Form generally elongated. Anterior end rounded where a mass of fat globules is found, while the posterior end terminates in a point. Size not exceeding 85μ by 20 to 25μ. The posterior part is sometimes divided into a certain number of lobes. In the protoplasm, the globules are clearly seen. Pseudopodia are localized at the anterior portion of the body. They are long, 40 to 50μ in length, filiform and very active in moving from back toward front, just like the motion of oars. Disporous.

Spore: Slightly elongated. Dimensions: sutural diameter 6 to 7μ, breadth 11 to 12μ.

LEPTOTHECA ELONGATA Thélohan

[Fig. 6]

1895	*Leptotheca elongata*	Thélohan	1895 : 332
1898	*Leptotheca elongata*	Doflein	1898 : 312
1917	*Leptotheca elongata*	Georgévitch	1917b : 99–106

Habitat: Gallbladder of *Merluccius merluccius* L. (*M. vulgaris*) and *Motella tricirrata*; Marseille, Banyuls, Le Croisic, Napoli, Monaco.

Vegetative form: Form variable. Many individuals show, however, a very characteristic form. It is elongated and has the length of about 120μ. The anterior end is enlarged into a disc-shaped depression, on the edge of which, the branched pseudopodia are formed. The body gradually narrows itself toward the posterior end. Also club-shaped, etc. The short lobose pseudopodia show no movement like that of oars.

Georgévitch's form: Young forms, oval or rounded, are attached to the epithelial cells of the bladder with a long filiform pseudopodium at the free end. Such forms often agglomerate in great number.

Spore: Form similar to the spore of *Leptotheca agilis*. Dimensions on the average: Sutural diameter 12 to 15μ, breadth 18 to 20μ.

LEPTOTHECA POLYMORPHA (Thélohan) Labbé

1895	*Leptotheca elongata*	Thélohan	1895 : 332–333
1899	*Leptotheca polymorpha*	Labbé	1899 : 88

Habitat: Gall-bladder of *Phycis mediterraneus* (*P. phycis* L.); Banyuls.

Vegetative form: Form extremely polymorphous, with three main types. 1) Somewhat regularly club-shaped, with lobose pseudopodia, sometimes filiform at one end. 2) Irregular as is the case with *Ceratomyxa truncata*, with long (25μ) ectoplasmic processes, which are motionless or very slow in motion. Lobose pseudopodia are formed actively. 3) More or less rounded with bristle-like filose pseudopodia. Intermediary forms are also found. Often many individuals unite together. The protoplasm is much different from other forms, i.e., more homogeneous and compact. Granules are hardly visible on account of vacuolar appearance.

Spore: Dimensions: sutural diameter 10 to 12μ, breadth 18 to 20μ, length of polar filament 40μ.

LEPTOTHECA PARVA Thélohan

[Fig. 7]

1895	*Leptotheca parva*	Thélohan	1895 : 333
1912	*Leptotheca parva*	Auerbach	1912 : 42–43

Habitat: Gall-bladder of *Scomber scombrus* L.; Marseille, Le Croisic, Le Vivier-sur-mer, Kristiansund, Stavanger, Bergen.

Vegetative form: Form ordinarily rounded, spherical or subspherical. Often club-shaped. Size not larger than 12 to 15μ in diameter. Protoplasm finely granular. Pseudopodia lobose.

Spore: Small, more or less elongated, curved in arch-form. Dimensions: sutural diameter 3 to 4μ, breadth 8 to 10μ.

LEPTOTHECA RENICOLA Thélohan

1895	*Leptotheca renicola*	Thélohan	1895 : 333

Habitat: Urinary tubules of the kidney of *Scomber scombrus* L.; Marseille, Le Croisic.

Vegetative form: Small. No marked character.

Spore: Globular. Form similar to the spore of Sphaerospora. Dimensions: sutural diameter 8μ, breadth 10μ.

LEPTOTHECA HEPSETI Thélohan

1895	*Leptotheca hepseti*	Thélohan	1895 : 334

Habitat: Gall-bladder of *Atherina hepsetus* L.; Marseille. Of rare occurrence; Thélohan observed it but once.

Vegetative form: Not described.

Spore: Form triangular with rounded angles. Dimensions: sutural diameter 7 to 8μ, breadth 12 to 15μ.

LEPTOTHECA PERLATA (Gurley) Labbé

[Fig. 8]

1883		Balbiani 1883 : 201, 204
1894	*Chloromyxum (Sphaerospora) perlatum*	Gurley 1894 : 272
1899	*Leptotheca perlata*	Labbé 1899 : 88

Habitat: *Acerina cernua* L.; France (?).

Vegetative form: Not described.

Spore: Elliptic. Two small polar capsules converging. Dimensions not given.

LEPTOTHECA sp. Awerinzew

[Figs. 16, 17]

1908	*Leptotheca* sp.	Awerinzew	1908 : 51, 52

Habitat: Gall-bladder of *Sebastes norvegicus*; Eastern Finmark?

Vegetative form: Rounded form with clear differentiation of protoplasm into ectoplasm and endoplasm. Plasmotomy occurs.

Spore: Undescribed. No figure.

LEPTOTHECA MACROSPORA Auerbach

[Fig. 9]

1909	*Leptotheca macrospora*	Auerbach	1909 : 70–71
1910	*Leptotheca macrospora*	Auerbach	1910b : 768–769
1910	*Leptotheca macrospora*	Auerbach	1910c : 167
1912	*Leptotheca macrospora*	Auerbach	1912 : 42–43

Habitat: Gall-bladder of *Sebastes viviparus* H. Kr. and *S. dactylopterus*; Bergen, Kristiansund (May, September).

Vegetative form: Trophozoites spherical with the average diameter of 26 to 30μ. Homogeneous ectoplasm layer exhibits somewhat active ameboid movements. Endoplasm, granular in living specimen, is rather sharply distinguishable from the ectoplasm and contains large nuclei.

Spore: Size large. Form resembles to that of *Leptotheca parva*. Dimensions: sutural diameter and thickness 13μ, breadth 26μ. Polar capsules short oval, with a length of 5.2μ, length of polar filament about 130μ (KOH). In the second host, a few normal and numerous abnormal spores with three or four polar capsules were observed.

LEPTOTHECA INFORMIS Auerbach
[Fig. 10]

1910	*Leptotheca informis*	Auerbach	1910b : 770–771
1912	*Leptotheca informis*	Auerbach	1912 : 42–44

Habitat: Gall-bladder of *Molva vulgaris* Flem. and *Gadus merlangus*; Bergen, Tjomo.

Vegetative form: Young trophozoites with somewhat long and narrow pseudopodia formed of hyaline ectoplasm; movements active. The protoplasm is differentiated into ectoplasm and endoplasm. When stained, two large (7 to 9μ) and two small (3 to 4μ) nuclei were observed in an individual, 27μ long excluding the pseudopodia. Sporulating trophozoites are generally round and each forms two spores, which are developed independently to each other (i.e., not in ordinary pansporoblast). Auerbach observed centrosomes in the nuclei of larger type in division. Disporous.

Spore: Large and heavily built. Greatly curved. Sutural line fairly well marked. Polar capsules round. Dimensions: sutural diameter 10μ, breadth 18 to 20μ, thickness 9μ, diameter of polar capsules 3 to 4μ. Sporoplasm contains two nuclei, 3.5 to 4μ in diameter.

LEPTOTHECA LONGIPES Auerbach
[Fig. 11]

1910	*Leptotheca longipes*	Auerbach	1910b : 771
1912	*Leptotheca longipes*	Auerbach	1912 : 42–43

Habitat: Gall-bladder of *Brosmius brosme* Asc.; Bergen (May).

Vegetative form: Trophozoites elongated or rounded. Only few pseudopodia which are very long. Small forms with a very long process, were observed in large numbers; length of the body being 10μ, while the process was 60μ long. Endoplasm contains nuclei of various sizes. Disporous.

Spore: Form similar to that of *Leptotheca informis*, though smaller. Dimensions: sutural diameter 8 to 9μ, breadth 12 to 14μ, thickness 8μ, diameter of polar capsule 2.5μ.

LEPTOTHECA FUSIFORMIS Davis
[Fig. 12]

1917	*Leptotheca fusiformis*	Davis	1917 : 222

Habitat: Gall-bladder of *Cestracion zygaena*; Beaufort (July).

Vegetative form: Pyriform, tapering gradually toward the posterior end, which usually terminates in a long, slender process; colorless and transparent. Progressive movements rapid. Endoplasm granular, the granules being more abundant at the anterior end. The average size of full-grown individuals: 50μ by 13μ. Disporous.

Spore: Elliptical in front view; fusiform in side view. Sutural plane slightly oblique to the longest diameter, the line forming a marked ridge. Polar capsules open on opposite sides of the spore. Sporoplasm finely granular, confined to the central part of spore. Dimensions: sutural diameter 9μ, breadth 16μ, polar capsule 4.5μ long, length of polar filament 30μ.

LEPTOTHECA SCISSURA Davis

[Fig. 13]

1917 *Leptotheca scissura* Davis 1917 : 222

Habitat: Gall-bladder of *Dasybatis hastatus* and *Pteroplatea maclura* Le Sue; Beaufort (July, August).

Vegetative form: Young form elongated, with long attenuated posterior process; usually slightly constricted just posterior to rounded anterior end, which bears numerous long, filiform pseudopodia. Progressive movement rapid. Ectoplasm distinguishable at the anterior end. Endoplasm usually filled with small, clear, colorless spherules, which become larger and yellowish as the body increases in size. Each spherule contains one to several dark-brown granules, which increase in size and number and finally collect in an irregular clump at the centre of spherule. The larger individuals are usually flattened dorso-ventrally. The posterior end is divided into long slender processes, presenting sometimes a network caused by the fusion of two or more adjacent processes. Full-grown forms: length 125 to 150μ, breadth 20 to 25μ. The longest observed, 195μ by 16μ. Disporous.

Spore: Elliptical in front view; somewhat flattened along the posterior side. Sutural line distinct and at right angles to the longest diameter. Polar capsules have foramina at some distance from the capsular margin. Sporoplasm finely granular, nearly filling both valves. Dimensions: sutural diameter 11μ, breadth 22μ, diameter of polar capsule 4μ.

LEPTOTHECA LOBOSA Davis

[Fig. 14]

1917 *Leptotheca lobosa* Davis 1917 : 223

Habitat: Urinary bladder of *Paralichthys dentatus* L.; Beaufort (July).

Vegetative form: Usually spherical which may form a large rounded pseudopodium composed of ectoplasm. Body colorless and transparent to translucent. Ameboid movements very slow. Ectoplasm contains coarse granules, which are of uniform size and very distinct. Endoplasm less granular and more transparent than ectoplasm, containing numerous large, yellow, fat globules, which are abundant in large forms. Diameter up to 24μ. Disporous.

Spore: Elliptical in front view; valves slightly tapering but rarely alike. Sutural line forming a sinuous ridge. Polar capsules open at some distance from the anterior margin. Sporoplasm nearly filling both valves. Free spores are often seen to remain united at the sutural line. Dimensions: sutural diameter 9 to 10μ, breadth 16 to 18μ; diameter of polar capsule 3μ.

LEPTOTHECA GLOMEROSA Davis
[Fig. 15]

1917	*Leptotheca glomerosa*	Davis	1917 : 223

Habitat: Urinary bladder of *Paralichthys albiguttus*; Beaufort.

Vegetative form: Rounded or somewhat irregular in shape, with short lobose pseudopodia. Body transparent and colorless. Ameboid movements slow. Ectoplasm hyaline, forming a distinct outer layer. Endoplasm finely granular, with numerous small fat globules varying in size. Almost entire body is used for spore formation. Diameter of rounded sporulating trophozoite about 11μ. Disporous.

Spore: Approximately cylindrical; valves rounded at ends. The coiled polar filament not visible in the polar capsule. Sutural line at right angles to the longest diameter. Sporoplasm finely granular, fills the extracapsular cavity of spore. Dimensions: sutural diameter 4.5μ, breadth 9μ, diameter of polar capsule 2μ.

Genus CERATOMYXA Thélohan

1892	*Ceratomyxa*	Thélohan	1892 : 169, 171, 175
1895	*Ceratomyxa*	Thélohan	1895 : 334

The characters of the genus described on page 56.

Type species: *Ceratomyxa arcuata* Thélohan.

CERATOMYXA ARCUATA Thélohan
[Figs. 18 to 22]

1892	*Ceratomyxa arcuata*	Thélohan	1892a : 1091
1895	*Ceratomyxa arcuata*	Thélohan	1895 : 335–336
1899	*Ceratomyxa arcuata*	Labbé	1899 : 90
1912	*Ceratomyxa arcuata*	Parisi	1912 : 290–291
1913	*Ceratomyxa arcuata*	Jameson	1913 : 2
1916	*Ceratomyxa arcuata*	Georgévitch	1916a : 3

Habitat: Gall-bladder of *Pagellus centrodontus* C. et V., *Crenilabrus melops* L., *Motella tricirrata* Bl., *Ophidium vasalli*, *Gobius paganellus* L., *Heliases chromis* Gthr.; *Scorpaena scrofa* L., *S. porcus* L.; France (Marseille, Banyuls, Concarneau, Roscoff), Italy (Napoli, summer), Monaco (May).

Vegetative form: Polymorphous; generally club-shape, pseudopodia localized at the broad end; the other end cylindrical or terminating in a sharp point. Some other different forms. Pseudopodia, always localized, lobose pointed at the extremities. Ectoplasm hyaline and thin. Endoplasm contains fat globules and particular elements, mostly large refractive globules, which seem to disappear in the sporulating individuals. Dimensions (maximum): length 35 to 40μ, breadth 12 to 15μ, pseudopodia about 10μ long. Disporous.

Spore: Arch form. Shell valves equal. Sporoplasm occupies the extracapsular cavity of the spore. The length varies rather considerably according to the development of the lateral processes, which are occasionally acuminated or very short. Often extremities are rounded. Dimensions (Thélohan); breadth 20 to 30μ, sutural diameter 5 to 8μ. Parisi's measurements: breadth 25 to 31μ, sutural diameter 5.5 to 6μ, length of polar capsules 3.5 to 4μ, length of polar filaments 25μ.

Remarks: The writer agrees with Parisi in eliminating Labbé's two subspecies (1899:90), as they are too arbitrary.

CERATOMYXA SPHAERULOSA Thélohan

[Figs. 23 to 24]

1892	*Ceratomyxa sphaerulosa*	Thélohan	1892 : 171
1895	*Ceratomyxa sphaerulosa*	Thélohan	1895 : 334–335
1909	? *Ceratomyxa sphaerulosa*	Auerbach	1909 : 80
1912	*Ceratomyxa sphaerulosa*	Auerbach	1912 : 4, 45
1916	*Ceratomyxa sphaerulosa*	Georgévitch	1916a : 3

Habitat: Gall-bladder of *Mustelus canis* Mitch. (*M. vulgaris*), *Galeus galeus* L. (*G. canis*), *Clupea harengus*, *Scullium canicula* Cuv.; St-Valery-en-Caux, Roscoff, Bergen, Monaco (May).

Vegetative form: Form more or less definite among the adults. Generally elongated. Both ends slightly attenuated. Wide in the middle part of the body. Lobose pseudopodia at one of the extremities. Others more massive or more or less regularly spherical, in which case the pseudopodia are formed from the whole surface. Spherical form does not exceed 50 to 60μ in diameter. Other forms 90 to 100μ by 30 to 40μ (largest). Young forms colorless and are more variable than the adults. Protoplasm homogeneous and finely granular. Adult form, on the contrary, yellowish or greenish yellow. The endoplasm is filled with small (5μ in diameter) spheres, in the centre of which 5 to 6 small granules, yellowish brown or greenish in color, are present. Disporous.

Spore: Remarkably large. Polar filament can be seen *in vivo* (easily extruded by KOH, ether, etc.) Sporoplasm occupies one of the shell-valves, while a small mass of very pale looking substance is seen in the other. Dimensions: sutural diameter 10 to 12μ, breadth 90 to 100μ, subspherical polar capsule 6 to 7 by 5μ, sporoplasm 12 to 15 by 8 to 9μ.

CERATOMYXA PALLIDA Thélohan

1895	*Ceratomyxa pallida*	Thélohan	1895 : 336–337
1898	*Ceratomyxa pallida*	Doflein	1898 : 341
1916	*Ceratomyxa pallida*	Georgévitch	1916b : 2, 3

Habitat: Gall-bladder of *Box boops* L. and *B. salpa* L.; Marseille, Villefranche, Rovigno, Monaco (May).

Vegetative form: Ordinarily spherical not exceeding 16 to 20μ in diameter. Many individuals often found in massive groups. Pseudopodia lobose and mostly short. Protoplasm extremely pale with fine granules.

Spore: Dimensions: sutural diameter 5μ, breadth 25 to 30μ.

CERATOMYXA GLOBULIFERA Thélohan
[Fig. 25]

1895	*Ceratomyxa globulifera*	Thélohan	1895 : 338

Habitat: Gall-bladder of *Merluccius merluccius* L. (*M. vulgaris*); Marseille, Banyuls.

Vegetative form: Polymorphous. Elongated into long branches, including endoplasm. Endoplasm contains small refractive globules.

Spore: Elongated. Shell-valves unequal, one being longer and finer than the other. Dimensions: sutural diameter 10μ, breadth 50μ.

CERATOMYXA APPENDICULATA Thélohan
[Fig. 26]

1892	*Ceratomyxa appendiculata*	Thélohan	1892a : 963–964
1895	*Ceratomyxa appendiculata*	Thélohan	1895 : 337
1898	*Ceratomyxa appendiculata*	Doflein	1898 : 300, 311

Habitat: Gall-bladder of *Lophius piscatorius* L., *L. budegassa* Spin.; Roscoff, Le Croisic, Marseille, Banyuls, Napoli, Rovigno.

Vegetative form: Extremely polymorphous. Young form spherical, spatulaform, club-shape, etc. In adult form, the main thick part of the body, in which spore formation takes place, forms 1 to 6 long prolongations, twice or three times longer than the main part of the body. Pseudopodia lobose, filiform or elongated with enlargements. Disporous.

Spore: Lateral prolongations of shell-valves well developed. Dimensions: sutural diameter 5 to 7μ, breadth 50μ.

CERATOMYXA TRUNCATA Thélohan
[Fig. 27]

1895	*Ceratomyxa truncata*	Thélohan	1895 : 336
1912	*Ceratomyxa truncata*	Parisi	1912 : 289–290

Habitat: Gall-bladder of *Clupea pilchardus* Walb. (*Alosa sardina*); Marseille, Villefranche, Napoli (August, September).

Vegetative form: Polymorphous. Ordinarily more or less rounded, with lobose pseudopodia. Pseudopodia long and often shows very active movements. Endoplasm very finely granular, contains small fat globules which are found in irregular mass or in a circular form. Disporous.

Spore: Valves are short and truncate. Sporoplasm occupies the whole cavity. Spores with three valves are frequently encountered. Dimensions: breadth 25μ, 5μ in sutural diameter. According to Parisi, spores with two shell-valves are rather few (10%), while those with three (70%) and four shell-valves (20%) prevail in number! Dimensions: breadth 20 to 30μ, length of the polar filament 45μ.

CERATOMYXA RETICULARIS Thélohan

[Fig. 28]

1895 *Ceratomyxa reticularis* Thélohan 1895 : 337–338

Habitat: Gall-bladder of *Trachinus draco* L.; Banyuls.

Vegetative form: Extremely polymorphous. Generally spherical or club-shaped. Well developed trophozoites have the similar form as in *C. appendiculata*. Endoplasm highly reticular, with refringent fluid.

Spore: Shell valves are short and truncate, one of which is curved to the rear. Dimensions: sutural diameter 12 to 15μ, breadth 45 to 50μ.

CERATOMYXA INAEQUALIS Doflein

[Fig. 29]

1898 *Ceratomyxa inaequalis* Doflein 1898 : 284–285

Habitat: Gall-bladder of *Crenilabrus mediterraneus* and *C. pavo*; Napoli.

Vegetative form: Form usually club-shaped. Protoplasm in active motion, is differentiated distinctly into ectoplasm and endoplasm. Body yellowish brown by the presence of granules in endoplasm. Inactive formation of pseudopodia. Ameboid movements or progressive movements by means of the posterior process. Size: 20 to 40μ by 5 to 10μ in average. Length of the posterior process up to 30μ. After spore formation, only two nuclei remain in protoplasm, which apparently degenerate later. Disporous.

Spore: Elliptical, somewhat flattened. Massive. Very transparent. Both ends round, but unequally built, i.e., one end is club-shaped. Polar capsules are somewhat round and are bound to the shell by protoplasmic bridges. The polar filament is not seen in fresh spores. Dimensions: sutural diameter 6μ, breadth 31μ, diameter of the polar capsule 2.5 to 3μ, length of polar filament is half breadth of the spore (diluted nitric acid).

CERATOMYXA LINOSPORA Doflein

[Figs. 30 to 31]

1898	*Ceratomyxa linospora*	Doflein	1898 : 285

Habitat: Gall-bladder of *Labrus turdus*; Napoli.

Vegetative form: Club- or spindleshape. Protoplasm highly granulated. Body whitish grey, though very transparent. Pseudopodia very fine and only formed at the anterior end of the body. Size: 30 to 35μ by 16 to 18μ. Disporous.

Spore: Form symmetrical with long thread-like lateral processes. In sporoblast, the processes are wound around the spore. It is twice as long as the breadth of the spore. Polar capsules large and spherical pyriform. Dimensions: total breadth 50μ, breadth of the main part of the spore 10 to 12μ, sutural diameter 5μ, length of lateral process 20μ. "Polar filament was too fine to be measured."

CERATOMYXA RAMOSA Awerinzew

[Figs. 32 and 33]

1907	*Ceratomyxa ramosa*	Awerinzew	1907 : 831–834
*1908	*Ceratomyxa ramosa*	Awerinzew	1908 : 60–66

Habitat: Gall-bladder of *Hippoglossus vulgaris* Flemm.; Kjellebjord, Murman coast.

Vegetative form: Form irregular ameboid, owing to the presence of peculiar pseudopodia. The middle part of the body is enlarged into an ellipsoidal form, where nuclei and sporoblasts are present. From this part two, rarely one or three processes are formed, which branch out several pseudopodia of different length. The finer portions of pseudopodia anastomose each other and form a characteristic and remarkable network. Differentiation of protoplasm is not very distinct. Ectoplasm is not well developed, tho covering the entire surface of the body as a thin layer. Endoplasm slightly vacuolated and granular, forms the greater part of the body. Disporous and polysporous.

Spore: Form and size (?) resemble *C. arcuata*. Slightly curved toward the posterior side. Valves usually unequally built, one being longer than the other. Sporoplasm almost always asymmetrically situated in the shell. Polar capsules on each side of the sutural plane and of the plane perpendicular to the sutural plane, cutting the spore into two equal parts. Young spores in development ellipsoidal to kidney bean shape. Dimensions: sutural diameter 12 to 20μ, breadth 50 to 80μ.

*Professor J. Zeitlin has kindly translated some part of the paper, for which the writer expresses his thanks.

CERATOMYXA DREPANOPSETTAE Awerinzew

[Figs. 34 to 39]

1907	*Ceratomyxa* sp.	Awerinzew	1907 : 832–833
1908	*Ceratomyxa drepanopsettae*	Awerinzew	1908 : 1–41, 45–47
1909	*Ceratomyxa drepanopsettae*	Awerinzew	1909 : 74–112
1912	*Ceratomyxa drepanopsettae*	Auerbach	1912 : 44–45
1918	*Ceratomyxa drepanopsettae*	Kudo	1918 : 14–15

Habitat: Gall-bladder of *Pleuronectes platessa, P. flesus, Drepanopsetta plattessoides, Hippoglossus vulgaris, Hippoglossoides limandoides* and *Paralichthys dentatus*; Murmankuste, Kabelvaag, Rorvik, Tjomo, Woods Hole (August, September).

Vegetative form: Polymorphous. Usually very much elongated and slender forms. Protoplasm differentiated. Endoplasm coarsely granular. Pseudopodia lobose and filiform (2 to 3μ), with which the trophozoites attach themselves to the epithelium of the bladder. Disporous.

Spore: Curved toward the posterior side. Shell with rounded ends. Valves almost always unequally built. Dimensions: breadth 50 to 80μ. Auerbach's form: Form variable. Size: sutural diameter about 12 to 14μ, breadth about 56μ, diameter of polar capsule about 4 to 6μ, length of the cavity in which the sporoplasm is located about 34μ. Kudo's form: Variable. Sutural diameter 8 to 10μ, average breadth 64μ, diameter of polar capsule 6μ.

CERATOMYXA TYLOSURI Awerinzew

[Figs. 40 and 41]

1913	*Ceratomyxa tylosuri*	Awerinzew	1913a : 153

Habitat: Gall-bladder of *Tylosurus schismatorhynchus*; Lorenço Marques, Delagoa Bay (Africa).

Vegetative form: Large, irregular, disc-like or large ameboid, with blunt lobose pseudopodia and highly granular protoplasm.

Spore: Large. The anterior edge arch-shape, while the posterior edge has two small horns which are located symmetrically to the sutural line. Polar capsules elongated and are separated from binuclear sporoplasm by a special membrane. Rarely spore with three polar capsules. Dimensions breadth 124 to 140μ, sutural diameter 40 to 45μ, thickness 25 to 30μ.

CERATOMYXA (?) SPARI Awerinzew

[Figs. 42 and 43]

1913	*Ceratomyxa* (?) *spari*	Awerinzew	1913a : 153–154

Habitat: Gall-bladder of *Sparus berda*; Lorenço Marques, Delagoa Bay (Africa).

Vegetative form: Large (100 to 120μ), disc-form ameboid, containing a large number of enclosures and granules of different size. In one case, a number of this form, carrying no spore, underwent budding, which resulted in forming spherical forms of various size, some of which divided again into 2 to 6 parts (Plasmotomy?). Monosporous and disporous.

Spore: More or less curved. Two polar capsules lie closely together on each side of the sutural plane. Ends of shell-valves are rounded. Dimensions: breadth 50 to 60μ, sutural diameter 12 to 15μ, thickness 12 to 15μ, polar filament very long (length not given).

Remarks: Awerinzew thinks this is the intermediate form between Leptotheca and Ceratomyxa.

CERATOMYXA sp. (?) Awerinzew

1913	*Ceratomyxa* sp. (?)	Awerinzew	1913a : 154

Habitat: Gall-bladder of *Scatophagus argus*; Delagoa Bay (Africa).

Vegetative form: Small, disc-form ameboid (25 to 35μ), containing two spores of indistinct contour, on account of incomplete formation of the shell. Two spores, apparently, developed in one pansporoblast. Disporous.

Spore: Form could not exactly be made out. Polar capsules were arranged like those of other Ceratomyxa.

CERATOMYXA sp. (?) Awerinzew

1913	*Ceratomyxa* sp. (?)	Awerinzew	1913a : 154–155

Habitat: Gall-bladder of *Rhinobathus* Awer. (?); Lorenço Marques (Africa).

Vegetative form: Irregular shape. Endoplasm highly granular. In the epithelial layer of the gall-bladder numerous, spherical cysts (30 to 35μ) were found. Two spores are formed in one pansporoblast. Disporous.

Spore: Cylindrical with broad and slightly rounded ends. Dimensions: sutural diameter 16 to 19μ, breadth 70 to 80μ, thickness 16 to 19μ.

CERATOMYXA ACADIENSIS Mavor

[Figs. 44 to 47]

1915	*Ceratomyxa acadiensis*	Mavor	1915 : 27–30
1916	*Ceratomyxa acadiensis*	Mavor	1916 : 551–574

Habitat: Gall-bladder of *Urophycis chuss* (trophozoites are attached to undetermined Myxosporidia, see p. 176), *Zoarces angularis*, *Pseudopleuronectes americanus*; New Brunswick (Canada) (July to September).

Vegetative form: Polymorphous. Typically club-shaped with very long tail, or irregularly stellate. Pseudopodia show rigidity. Sometimes clumps of protoplasm along their length, which are connected by thin hyaline filaments of ectoplasm. Differentiation of protoplasm is usually observable at the anterior region. Dimensions: length, excluding tail, 12 to 15μ, breadth 10 to 20μ, tail up to 60μ. Disporous.

Spore: Wide, short and slightly compressed dorso-ventrally, with very long fine lateral filaments. Polar capsules spherical. Polar filament invisible *in vivo*. Dimensions: breadth 40 to 50μ, sutural diameter 7 to 8μ, diameter of polar capsule 3 to 4μ, length of polar filament 70μ, length of lateral filaments 250 to 300μ.

CERATOMYXA sp. Georgévitch

1916	*Ceratomyxa* sp.	Georgévitch	1916a : 3

Habitat: Gall-bladder of *Muraena* sp.; Monaco (May).
Vegetative form: No description.
Spore: No description. No figure.

CERATOMYXA CORIS Georgévitch
[Fig. 48]

1916	*Ceratomyxa coris*	Georgévitch	1916a : 4–5
1917	*Ceratomyxa coris*	Georgévitch	1917a : 1–20

Habitat: Gall-bladder of *Coris julius*, *C. giofredi*; Villefranche (March, June).

Vegetative form: Various forms, club-shape, spherical or elongated, with lobose or filiform pseudopodia. Disporous and rarely Polysporous.

Spore: More or less ellipsoidal. Lateral prolongations of the shell-valves short and truncate. Sutural line straight. Sporoplasm, elongate, rounded, elliptical, fills a part of the extracapsular cavity of the spore. Polar capsules rounded, almost spherical, not converging. Dimensions not given.

Remarks: Georgévitch observed (1917: Fig. 30) that spores of *Glugea marionis* occurred in disporous trophozoite of *Ceratomyxa coris*, which he thought to have happened accidentally by plasmogamy of these two Cnidosporidia. The above mentioned figure, however, strongly suggests that *G. marionis* may be leading parasitic life in the trophozoite of *C. coris*.

CERATOMYXA HEROUARDI Georgévitch
[Fig. 49]

1913	*Leptotheca* (?) sp.	Jameson	1913 : 2
1916	*Ceratomyxa herouardi*	Georgévitch	1916a : 5–8
1916	*Ceratomyxa herouardi*	Georgévitch	1916b : 717–19, 983–985
1917	*Ceratomyxa herouardi*	Georgévitch	1917 : 375–399

Habitat: Gall-bladder of *Box Salpa* L.; Monaco (May).

Vegetative form: Polymorphous. Elongated with same breadth or tapering to one end; club-shaped with roundish enlargements. Young trophozoites spherical or pyriform. Pseudopodia long and narrow or broad and bi- or multi-lobate. Body colorless both in the young and the adult. Protoplasm homogeneous and finely granular. Disporous and polysporous. Spores are found inside of the endoplasm and in the roundish buds, ordinarily two spores being formed in each bud. Number of buds on one trophozoite varies. Plasmotomy by budding and division.

Spore: Elongated elliptic. Polar capsules spherical and large. Sutural plane cuts the spore into exactly equal two parts. Two nuclei in sporoplasm are rather small and are always in one of the shell-valves. Dimensions not given.

Remark: The form, mentioned by Jameson in the same seat, host and locality, that "has something of the appearance of a Leptotheca" and that is also "almost certainly neither of the two Myxosporidia—*Ceratomyxa pallida* and *Henneguya neapolitana* . . . ," is probably identical with the present form.

CERATOMYXA MESOSPORA Davis

[Fig. 50]

1917	*Ceratomyxa mesospora*	Davis	1917 : 223–224

Habitat: Gall-bladder of *Cestracion zygaena*, *C. tiburo*; Beaufort (July).

Vegetative form: Pyriform, elongate, with long, slender posterior process. Numerous filiform pseudopodia at anterior end. Progressive movements rapid. Body colorless. No sharp demarcation between ectoplasm and endoplasm. Endoplasm finely granular and filled with small, colorless, homogeneous spherules. Spherules absent at anterior end. Size: total length 70 to 85μ, length exclusive of posterior process 50 to 75μ, breadth 20 to 25μ. Disporous.

Spore: Greatly elongate, each valve forming a slightly tapering cone, rounded at the apex. Valves not compressed. Sutural plane forming an acute angle with the longest diameter. Polar capsules conspicuous. Coiled polar filaments very distinct. Polar capsules are remarkable in that they are asymmetrically situated, one being always located in the widest part of the spore, while the other being a little to one side. Sporoplasm asymmetrically situated, sometimes being entirely confined to the larger valve. Dimensions: breadth 50 to 65μ, sutural diameter about 8μ, diameter of polar capsule 4.5μ, length of polar filament 90μ.

Remarks: Similar to *C. sphaerulosa* Thél. and occurs with *C. recurvata* Davis in the same organ.

CERATOMYXA SPHAIROPHORA Davis

[Fig. 51]

1917	*Ceratomyxa sphairophora*	Davis	1917 : 224

Habitat: Gall-bladder of *Scoliodon terrae-novae*; Beaufort.

Vegetative form: Pyriform, elongate. Numerous fine filiform pseudopodia at anterior end. Progressive movements rapid. Body colorless and transparent. Ectoplasm clear and homogeneous. Structure of endoplasm highly variable, in majority of trophozoites filled with transparent homogeneous spherules. Small fat globules at the anterior end. In some sporulating individuals, the endoplasm shows vacuolated structure without any spherules, usually, however, sporulating trophozoites exhibit well-defined spherules. The spherules or vacuoles, as the case may be, are separated by a thin layer of distinctly granular endoplasm containing numerous rod-shaped or rounded, colorless bodies, which in their appearance are strikingly like small bacteria tho they are not bacteria, as they fail to take Giemsa stain. Size of sporulating trophozoites 100 to 110μ by 25μ. Disporous.

Spore: Shell-valves greatly elongated, tapering gradually toward the ends. Long, attenuated ends of valves hollow and so fragile that it is almost impossible to find an example in which they are not more or less distorted. Sutural plane perpendicular or only slightly oblique to the longest diameter. Polar capsules are spherical and large; slightly convergent, opening some distance apart on the anterior side. Coiled polar filament distinct. Sporoplasm confined to large, central part of spores, but extending farther into one valve than the other. Dimensions: total breadth 115 to 140μ, sutural diameter about 12μ, diameter of polar capsules 6μ, length of polar filament 75μ.

CERATOMYXA TAENIA Davis

[Figs. 52 and 53]

1917	*Ceratomyxa taenia*	Davis	1917 : 224–225

Habitat: Gall-bladder of *Scoliodon terrae-novae*; Beaufort.

Vegetative form: Similar to those of *C. sphairophora* Davis, and no character has been found by which they may be distinguished. Sporulating trophozoites can be easily distinguished on account of the very different appearance of the spore and their different arrangement within the trophozoites. The spores of this species are situated, as is usually the case in Ceratomyxa, with the greater part of the spore parallel to the long axis of the trophozoite, only a part of one valve being bent back along the rest of the spore. Size: sporulating trophozoites length 80μ, breadth 25μ. Disporous.

Spore: Valves greatly elongated. Shell very thin, the membrance on opposite sides of each valve being in contact for about two-thirds of its length, forming a thin ribbonlike structure; basal third of each valve only slightly compressed; terminal ribbonlike portion of each valve usually twisted so that plane of ribbon is at right angles to the main part of the spore. Polar capsules small, pyriform to spherical and convergent. Coiled polar filament indistinct. Sutural plane perpendicular to the longest diameter. Sporoplasm finely granular, filling the basal third of each valve, sometimes extending farther into one valve than the other. Dimensions: breadth 140 to 150μ, breadth of central portion 45μ, sutural diameter 6μ, diameter of the polar capsules 3μ.

CERATOMYXA ATTENUATA Davis
[Fig. 54]

1917	*Ceratomyxa attenuata*	Davis	1917 : 225

Habitat: Gall-bladder of *Scoliodon terrae-novae*; Beaufort (July).

Vegetative form: Elongate, pyriform, with long, tapering posterior process; at anterior end numerous long filiform pseudopodia. Progressive movements rapid. Ectoplasm distinct only at anterior end. Endoplasm filled with small, refractive, yellowish or brownish granules, which are uniformly distributed throughout the trophozoite. Between the brownish granules, the endoplasm is clear and colorless, not granular, except at extreme anterior end where it contains a clump of small fat globules. Size of full-grown trophozoites 100 to 120 by 27 μ. Disporous.

Spore: Valves greatly elongated; a symmetrical, one valve being about 15μ shorter than the other and ending abruptly; the longer valve tapering gradually to a point. About midway of each valve, is a thin septum; external to the septum the valves are empty. Polar capsules are large, opening on the anterior margin. Coiled polar filaments distinct. Sutural plane oblique to longitudinal axis, usually forming a ridge. Sporoplasm asymmetrically situated in central part of the spore. Dimensions: breadth 115μ, sutural diameter 9μ, diameter of polar capsules 4.5μ, length of polar filament 60μ.

CERATOMYXA RECURVATA Davis
[Figs. 55 and 56]

1917	*Ceratomyxa recurvata*	Davis	1917 : 225–226

Habitat: Gall-bladder of *Cestracion zygaena*; Beaufort (July).

Vegetative form: Pyriform with long, slender posterior process. Body colorless. Actively motile, forming filiform pseudopodia of ectoplasm at anterior end. Endoplasm colorless and granular, filled with large, homogeneous spherules. Full-grown trophozoites 130 to 175μ, length of the main body about 100μ. Spores are developed singly from distinct sporoplasts and not necessarily in pairs. Disporous and polysporous (up to 10 spores, 6 and 8 are common numbers).

Spore: Valves greatly curved toward the posterior side, usually symmetrical, but occasionally one may be much more incurved than the other. Valves circular in cross section at the base but toward the ends greatly flattened. Ends of valves sharply pointed. Polar capsules large, opening at some distance from the anterior margin. Coiled polar filaments distinct. Sporoplasm finely granular usually extending farther into one valve than the other. Dimensions: breadth between points of greatest curvature about 16μ, sutural diameter 8 to 9μ, diameter of polar capsules 4.5μ.

CERATOMYXA LUNATA Davis

[Figs. 57 to 60]

1917 *Ceratomyxa lunata* Davis 1917 : 226–227

Habitat: Gall-bladder of *Galeocerda tigrinus*; Beaufort (August).

Vegetative form: Pyriform, rounded after being on the slide for some time. Progressive movements slow Endoplasm filled with large, homogeneous spherules, which are usually colorless, sometimes light yellow. At extreme anterior end, the endoplasm contains numerous small fat globules. Disporous.

Spore: Considerably variable in size and form. The larger and more typical are more or less crescent-shaped; symmetrical; valves curved toward rear, terminating in more or less rounded ends. Polar capsules large and open on opposite sides of spore. Coiled polar filament distinct. Sporoplasm finely granular, symmetrically situated in spore. Smaller spores differ from large ones chiefly in size; valves are much shortened and have a greater curvature, with more distinctly rounded ends. Dimensions: breadth 30μ (longest 38μ), sutural diameter 9μ, diameter of polar capsules 4μ, length of polar filament 37μ. Small forms: breadth 15μ, sutural diameter 7μ, diameter of polar capsules 3μ.

CERATOMYXA ABBREVIATA Davis

[Fig. 61]

1917 *Ceratomyxa abbreviata* Davis 1917 : 227

Habitat: Gall-bladder of *Scoliodon terrae-novae*; Beaufort (August).

Vegetative form: Elongate, pyriform, with usually a very long, slender posterior process. Body colorless. Progressive movements rapid. Distinct differentiation of protoplasm, posterior process usually composed of ectoplasm (rarely endoplasm may extend into it for a short distance). Pseudopodia, short, tapering or filiform at anterior end. Dimensions: length up to 90μ, breadth 10 to 12μ, diameter of rounded sporulating trophozoites about 27μ. Disporous.

Spore: Roughly crescent-shaped; sutural diameter exceptionally great in comparison with the breadth. Ends of valves rounded, slightly asymmetrical. Shell exceptionally tough and resistant to reagents. Polar capsules large, prominent and open on opposite sides of spore. Sporoplasm finely granular, confined entirely to one valve. Dimensions: breadth 17μ, sutural diameter 14μ, diameter of polar capsules 4.5μ.

CERATOMYXA FLAGELLIFERA Davis

[Fig. 62]

1917 *Ceratomyxa flagellifera* Davis 1917 : 227

Habitat: Gall-bladder of *Carcharhinus* sp?; Beaufort (July).

Vegetative form: Pyriform, short, tapering toward the posterior end, sometimes dividing into a number of long, slender, transparent processes. Extremely long filiform pseudopodia, developed at anterior end, can be seen to sweep slowly back like a whiplash until they come to lie by the side of the body. Progressive movements slow. Ectoplasm clear, transparent, forming a distinct layer at anterior end. Endoplasm in large trophozoites filled with large numbers of rod-shaped, bacteria-like bodies, which are more abundant in the anterior half than in the posterior. Endoplasm in younger trophozoites, with much less or without any bacteria-like bodies, shows a vacuolated structure. Size up to 115 to 120μ in length and 40 to 45μ in breadth. Disporous.

Spore: Valves greatly elongated, conical, with rounded ends. Sutural ridge well marked. Polar capsules large, opening on opposite sides of spore. Coiled polar filament very distinct. Sporoplasm granular, symmetrically situated, but extending only a short distance into each valve. Dimensions: breadth 118μ, sutural diameter 12μ, diameter of polar capsules 6μ.

CERATOMYXA AGGLOMERATA Davis

[Fig. 63]

1917 *Ceratomyxa agglomerata* Davis 1917 : 228

Habitat: Gall-bladder of *Synodus foetans*; Beaufort.

Vegetative form: Pyriform, usually with long, slender, posterior process. Body colorless and transparent. Actively motile, moving by means of characteristic wavelike movements of the ectoplasm, from which are projected numerous short, conical to filiform pseudopodia. Pseudopodia travel back along sides of body for about one-third its length and then disappear, new ones being continually formed at the anterior end. Ectoplasm distinguishable at anterior end. Endoplasm clear, very transparent, usually homogeneous, sometimes finely granular. Large numbers of fat globules usually present. Size of sporulating trophozoites 38μ by 12μ. Disporous.

Spore: Asymmetrical, one valve being smaller and more attenuated than the other; larger valve compressed. Polar capsules spherical. Coiled polar filaments indistinct. Sporoplasm filling nearly entire smaller valve, but only extending a short distance into the larger one. Dimensions: breadth 24 to 28μ, sutural diameter 5μ, diameter of polar capsules 3μ.

CERATOMYXA AMORPHA Davis
[Fig. 64]

1917	*Ceratomyxa amorpha*	Davis	1917 : 228

Habitat: Gall-bladder of *Synodus foetans*; Beaufort.

Vegetative form: Rounded or irregular in shape, with short lobose pseudopodia; not pyriform; slowly ameboid. Body colorless. Ectoplasm well developed, forming a distinct layer; transparent, finely granular. Endoplasm granular, with large numbers of small fat globules scattered through it or aggregated into one or two large clumps (difference between the present form and *C. agglomerata*). Disporous.

Spore: Asymmetrical; crescent-shaped; valves short, conical, somewhat compressed. One valve distinctly smaller and more conical than the other. Sutural ridge perpendicular to longitudinal axis. Polar capsules large, opening at some distance from the anterior side. Coiled polar filaments distinct. Sporoplasm granular, asymmetrically situated, being chiefly confined to smaller valve. Dimensions: breadth 27μ, sutural diameter 11μ, diameter of polar capsules 4μ.

CERATOMYXA MONOSPORA Davis
[Figs. 65 to 67]

1917	*Ceratomyxa monospora*	Davis	1917 : 228–229

Habitat: Gall-bladder of *Peprilus alepidotus*; Beaufort. Abundantly present in June, much less in July, being entirely absent in the bladder at the end of the month.

Vegetative form: Pyriform, with a slender posterior process and one to several filiform pseudopodia at anterior end. Body colorless and transparent. Movements very slow. No clear differentiation between ectoplasm and endoplasm, the entire body being composed of a clear, finely granular protoplasm. Fat globules more abundant in larger individual, which are aggregated into small clumps. Size of vegetative trophozoites up to 24μ in length and 15μ in width. Monosporous form much smaller than disporous. Monosporous and disporous. Nearly entire substance of trophozoite is used up in spore formation.

Spore: Crescent-shaped. Valves cylindrical, tapering toward the end, which is rounded and compressed. Curvature of valves varies. One valve is more attenuated than the other. Sutural ridge perpendicular to the longest diameter. Polar capsules large. Sporoplasm usually asymmetrically situated. Dimensions: breadth 18 to 25μ, sutural diameter 5 to 6μ, diameter of polar capsules 3μ.

Remarks: This species is evidently very close to *C. pallida* Thél. Similar form was found in *Prionotus evolans* (gall-bladder), which showed somewhat larger trophozoites and spores than *C. monospora*.

CERATOMYXA STREPTOSPORA Davis

[Figs. 68 and 69]

1917	*Ceratomyxa streptospora*	Davis	1917 : 229

Habitat: Gall-bladder of *Chaetodipterus faber*; Beaufort (June, but not in July).

Vegetative form: Pyriform, colorless and transparent. A few conical, filiform, wavelike pseudopodia at anterior end. Ectoplasm recognizable at anterior end. Endoplasm finely granular, with a few, small, fat globules, filled with transparent, homogeneous spherules. Size: 48 by 12μ to 60 by 9μ. Disporous.

Spore: Compressed valves greatly elongated, with rounded ends. Sutural ridge. Polar capsules spherical. Coiled polar filament indistinct. Sporoplasm finely granular, entirely filling both valves. Dimensions: breadth 34 to 39μ, sutural diameter 4μ, diameter of polar capsules 3μ.

CERATOMYXA AGGREGATA Davis

[Fig. 70]

1917	*Ceratomyxa aggregata*	Davis	1917 : 229

Habitat: Gall-bladder of *Leostomus xanthurus, Micropogon undulatus*; Beaufort (July).

Vegetative form: Form rounded to somewhat irregular in shape, rarely pyriform; slowly ameboid. Body colorless and transparent. No clear differentiation of protoplasm. Endoplasm finely granular, containing numbers of small fat globules. Sporulating trophozoites show a tendency to collect in groups composed of a large number of individuals so closely associated that it is often impossible to make out the individual outlines. Size of full-grown form 18μ by 14μ. Disporous.

Spore: Crescent-shaped; valves much elongated, tapering toward the ends, which are compressed. Polar capsules spherical and opaque. Sporoplasm granular, situated symmetrically in the spore cavity. Dimensions: breadth about 50μ, sutural diameter 6 to 7μ, diameter of polar capsule 3.5μ.

CERATOMYXA UNDULATA Davis

[Fig. 71]

1917	*Ceratomyxa undulata*	Davis	1917 : 230

Habitat: Gall-bladder of *Ancylopsetta quadrocellata* Gill.; Beaufort (June to August).

Vegetative form: Pyriform, sometimes fusiform, tapering toward posterior end. Movements rapid. Body colorless. Ectoplasm observable at anterior part, constantly undergoes rapid, wavelike undulating movements and extrudes fine conical or filiform pseudopodia. Pseudopodia are formed very rapidly and vary in length. After reaching a considerable length the pseudopodia usually travel posteriorly along sides of body and then disappear. Endoplasm very transparent, often vacuolated, containing numerous small fat globules. Size of full-grown trophozoite: 25μ by 10 to 12μ in average. Disporous.

Spore: Crescent-shaped. Valves cylindrical, not compressed, ends rounded, one valve being somewhat longer and more conical than the other. Polar capsules convergent. Coiled polar filaments distinct. Sporoplasm granular, asymmetrically situated, sometimes being almost confined to more conical valve. Dimensions: breadth 22 to 24μ, sutural diameter 6μ, diameter of polar capsules 3μ.

CERATOMYXA NAVICULARIA Davis

[Figs. 72 and 73]

1917	*Ceratomyxa navicularia*	Davis	1917 : 230

Habitat: Urinary bladder of *Paralichthys dentatus*, *P. albiguttus*, *Sphaeroides maculatus*; Beaufort (June to August).

Vegetative form: Rounded or slightly irregular in shape, never pyriform. Body colorless. Very slow ameboid. No distinct ectoplasm. Entire trophozoite finely granular, containing a few small fat globules. Nearly entire body is used up in the formation of spores. Diameter about 17μ. Disporous.

Spore: Variable in shape and size. Symmetrical or asymmetrical, often boat-shaped, slightly compressed dorso-ventrally, with rounded ends. Polar capsules convergent, shows polar filament indistinctly. Sporoplasm finely granular, extending into both valves, but usually somewhat farther into one than the other. Dimensions: breadth 14 to 22μ (average 16μ), sutural diameter 5 to 7.5μ (average 6μ), diameter of polar capsules 2μ.

CERATOMYXA SPINOSA Davis

[Fig. 74]

1917	*Ceratomyxa spinosa*	Davis	1917 : 230

Habitat: Urinary bladder of *Paralichthys albiguttus*; Beaufort.

Vegetative form: Rounded or slightly irregular in shape, with short, lobose pseudopodia; slowly ameboid. Body colorless and transparent. Distinct differentiation of protoplasm along the entire surface, ectoplasm forming outer layer. Endoplasm faintly granular, with numerous small fat globules. Monosporous and disporous.

Spore: Central portion greatly enlarged; ovoid, with very long tapering process extending out from each end. Sutural line perpendicular to the longest diameter. Polar capsules large and spherical. Sporoplasm finely granular, chiefly located in one valve, extending into the other only a short distance beyond the capsule. Dimensions: breadth 80μ, breadth of enlarged central portion 13μ, sutural diameter 7μ, diameter of polar capsules 4μ.

Genus MYXOPROTEUS Doflein emend. Davis

1898	*Myxoproteus*	Doflein	1898 : 287
1917	*Myxoproteus*	Davis	1917 : 219

The characters of the genus are described on page 56.
Type species: *Myxoproteus ambiguus* (Thélohan) Doflein.

MYXOPROTEUS AMBIGUUS (Thélohan) Doflein
[Figs. 75 to 80]

1895	*Myxosoma ambiguum*	Thélohan	1895 : 344
1898	*Myxoproteus ambiguus*	Doflein	1898 : 287–288

Habitat: Urinary bladder of *Lophius piscatorius*; Le Croisic, Rovigno, Napoli.

Vegetative form: Polymorphous. Color milky white. Protoplasm is filled with numerous granules and fat globules. Pseudopodia, short, pointed lobose. Plasmogamy and plasmotomy take place. Many small individuals formed apparently by plasmotomy, often, make up groups. Disporous, polysporous?

Spore: Almost pyramidal, with anterior processes. Two very large polar capsules at the anterior end. The distance between these capsules is equal to or greater than the diameter of the capsules. Sporoplasm with two nuclei. Dimensions: length 25μ, breadth 18 to 20μ, diameter of polar capsules 7μ.

MYXOPROTEUS CORDIFORMIS Davis
[Figs. 81 to 83]

1917	*Myxoproteus cordiformis*	Davis	1917 : 231

Habitat: Urinary bladder of *Chaetodipterus faber*; Beaufort (June, July).

Vegetative form: Rounded; very slowly ameboid, usually forming a single, short, lobose pseudopodium. Body colorless and transparent. Ectoplasm not distinct. Entire trophozoite finely granular, with a few fat globules. Rarely vacuolar. Small trophozoites often show a single large, central vacuole. Rounded sporulating trophozoites 18μ in diameter. Disporous.

Spore: Heart-shaped in front view, with peculiar wing-like expansions on each side which contain remains of parietal cells. Sutural plane oblique in position. Capsulogenous cells distinct. Sporoplasm finely granular, fills the extracapsular cavity of the spore. Dimensions: length 12μ, breadth 10 to 11μ, thickness 6μ, polar capsules 3 to 4μ in diameter.

MYXOPROTEUS CORNUTUS Davis
[Fig. 84]

1917	*Myxoproteus cornutus*	Davis	1917 : 231

Habitat: Urinary bladder of *Bairdiella chrysura*; Beaufort.

Vegetative form: Somewhat elongated or irregular in shape, with short lobose pseudopodia; slowly ameboid. Differentiation of protoplasm clear. Ectoplasm well developed, hyaline; in rounded individuals forming a distinct layer around the body. Endoplasm opaque, contains coarse refringent granules varying in shape, and a few fat globules. In contracted rounded resting condition, endoplasm becomes condensed, while ectoplasm appears more abundant. Rounded trophozoites up to 27μ in diameter. Disporous.

Spore: Heart-shaped, with two anterior processes. Shell very thick. Polar capsules large, opening some distance apart. Coiled polar filament distinct. Sporoplasm finely granular, with a few small fat globules, fills the extracapsular cavity of the spore. Dimensions: sutural diameter exclusive of the processes 9μ, breadth 12μ, length of processes 5μ, diameter of polar capsules 3μ.

Genus WARDIA nov. gen.

The characters of the genus are described on page 56.

Type species: *Wardia ovinocua* nov. spec.

WARDIA OVINOCUA nov. spec.
[Figs. 85 to 95]

Habitat: Ovum and connective tissue of ovary of *Lepomis humilis* Girard;* Salt Fork, Ill. (November). Only one fish, 6.5 cm. long with normal appearance, was found to be infected.

Vegetative form: Trophozoites form cysts visible to the naked eyes as white spherical spots in the pink-colored ovary. Four cysts present. The cyst (Figs. 85 and 86), in section, shows a circular form surrounded by several layers of hypertrophied nurse cells and connective tissue, in which many large blood vessels are present. Protoplasm is not clearly differ-

*Professor F. Smith of the Department kindly identified all the fish that were collected in the vicinity of Urbana and mentioned in this paper as hosts, for which the writer wishes to express his appreciation.

entiated into ectoplasm and endoplasm, the whole protoplasm showing granulated reticular structure. Cysts contained numerous fully developed spores and a small number of spores in developmental stages, which suggested the fact that two spores rise from each pansporoblast. The parasite is also found in the state of diffuse infiltration in the connective tissue around the cyst. Diameter of cysts 316 to 445μ in sections. Polysporous.

Spore: In front view, isosceles triangular form, two sides of which usually convex, with more or less attenuated anterior end (Figs. 87, 90, 92); in profile, ellipsoidal (Fig. 88); and oval viewed from the anterior end (Fig. 89). Sutural plane at right angles to the longest diameter (Figs. 87 and 89). Shell comparatively thin except at the anterior end and has many fine network-like ridges on the surface. These ridges are hardly observable on fresh spores on account of their fine form and the conspicuously large polar capsules lying in the spore. When stained, however, they are not only made distinctly visible, but the prolongation of each ridge from the posterior edge which forms about 1μ long fringe-like structure is also more clearly recognized (Figs. 90–95). Two large and spherical polar capsules located in the central portion of the spore. Coiled (5 to 6 times) polar filament extremely distinct. The openings of polar capsules at the anterior end. Sporoplasm comparatively small, finely granular, without any vacuole, contains two small nuclei, when stained. Dimensions in vivo: sutural diameter 9 to 10μ, breadth 10 to 12μ, thickness 6μ, diameter of the polar capsule 4μ, length of polar filament 35 to 45μ.

WARDIA OHLMACHERI (Gurley) Kudo

[Figs. 96 and 97]

1893	*Myxosporidian*	Ohlmacher	1893 : 561–567
1893	*Chloromyxum ohlmacheri*	Whinery	1893 : 660–662
1894	*Chloromyxum (Sphaerospora) ohlmacheri*	Gurley	1894 : 267–272
1895	? *Leptotheca ranae*	Thélohan	1895 : 383
1899	*Leptotheca ohlmacheri*	Labbé	1899 : 87

Habitat: Urinary tubules of kidney of *Bufo lentiginosus* Shaw and kidney of *Rana esculenta* and *R. temporaria* (*R. fusca*); Sycamore, De Kalb county, Ill.

Vegetative form: Not found.

Spore: Transversely elliptic. Sutural plane perpendicular to the longer axis of the spore. A well defined undulate-parallel longitudinal striation on the shell. Sutural ridge comparatively well marked. Two polar capsules lying side by side, occasionally only one. Dimensions: sutural diameter 6μ, breadth 8μ, diameter of polar capsule 3 to 3.5μ, length of polar filament 6 to 8 times the breadth of spore (48 to 64μ).

Remarks: This form is apparently very much different from any species of genus Leptotheca, in the general form, form of polar capsules, striations on the shell and the habitat. Tho the form of the spore is different from the type species of the genus Wardia and nothing is known about the vegetative form, the presence of large spherical polar capsules in the central portion of the spore, the striations on the shell and the occurrence of the same nature, i.e., from fresh waters in the close-by localities, show its nearer relationship to the genus Wardia than to the genus Leptotheca. Hence it is placed here provisionally.

Genus MITRASPORA Fujita emend. Kudo

1912	*Mitraspora*	Fujita	1912 : 259–260

The characters of the genus are described on page 56.

Type species: *Mitraspora cyprini* Fujita.

MITRASPORA CYPRINI Fujita

[Figs. 98 to 104]

1912	*Mitraspora cyprini*	Fujita	1912 : 259–260

Habitat: Renal tubules of kidney and ureters of *Cyprinus carpio* L. and *Carassius auratus* L.; Sapporo (winter), Tokio (March).

Vegetative form: Fujita's only description is as follows: "The sporoblast contains generally three or four spores." The present writer observed a similar form in the ureter and the renal tubule of the kidney of *Cyprinus carpio* L., in Tokio. The observations are as follows: Trophozoites small ameboid (Fig. 98). Body colorless. Movements tardy. Differentiation of protoplasm imperfect. The hyaline ectoplasm recognizable at one side of the body, where lobose pseudopodia are formed (Figs. 98–99). Endoplasm granular with vacuoles and brownish granules, which become larger as the body grows. Size 10 to 40μ. Disporous (Kudo) and polysporous (?, Fujita).

Spore: Fujita's descriptions are as follows: Form resembles monk's hood, slightly attenuated at its anterior end. Shell uniformly thin, except at two points of the truncated posterior end. Each shell valve has eight distinct striations which run longitudinally and turn into long cilia up to 5.8μ long, planted in a single row at the posterior end of the spore. Two polar capsules at the anterior end. The nucleus is obscure and no vacuole is present. Dimensions: length 10 to 13μ, breadth 5μ, polar capsules 3.8μ by 2μ, length of polar filament 15μ (weak glycerine). The writer observed the following facts: More rounded with rounded anterior end in front and side views. Shell more or less thick along the entire posterior margin. Striations on shell, variable in number. Sporoplasm granular, without any vacuole, exhibits two nuclei when stained. Posterior filaments 5 to 6 in number and 5 to 6μ long, being absent in some spores. Dimensions in vivo: length 10μ, breadth 8 to 9μ, thickness 6 to 8μ, polar capsule 4μ by 1.5 to 2μ, length of polar filament 35 to 40μ.

Remarks: Tho Fujita does not describe the vegetative form and there are some differences in the form and size of the spore between the forms, the writer does not find out any objection against the union of the above mentioned two forms.

MITRASPORA CAUDATA (Parisi) Kudo

[Figs. 105 to 107]

1910	*Sphaerospora caudata*	Parisi	1910 : 253–254
1912	*Sphaerospora caudata*	Parisi	1912 : 289
1913	*Sphaerospora caudata*	Parisi	1913 : 396–402

Habitat: Renal tubules of kidney of *Alosa finta* Cuv. var. *lacustris* Fatio; Lake Como.

Vegetative form: Rounded or variously elongated owing to the movements. Protoplasm is distinctly differentiated into ectoplasm and endoplasm. Ectoplasm, hyaline and homogeneous, forms slowly moving lobose pseudopodia. Endoplasm granular, contains yellow globules and fat granules. Disporous and polysporous.

Spore: Subspherical in front view; oval in profile; anterior end being more rounded than the posterior end. Shell rather thick, longitudinally striated. In front view, the posterior end enlarged into a quadrangular form, which appears as a small spine in side-view and which projects backward long and fine filaments, usually six in number. Two well developed polar capsules open on each side of the sutural plane. Polar filament coiled 5 to 6 times. Sporoplasm without any iodinophilous vacuole. Dimensions: external length 10 to 11μ, internal length 7 to 9μ, length of polar capsules 4 to 4.5μ, length of polar filament up to 48μ, length of posterior filaments up to 28μ.

MITRASPORA ELONGATA nov. spec.

[Figs. 602 to 621]

Habitat: In the urinary tubules and tissue of kidney of *Lepomis cyanellus*; Crystal Lake, Urbana, Ill. From June to July, all the fish examined, 36 in number and 10 cm. in average length, were found to be infected. Other fish such as *Lepomis pallidus* and *Lepomis humilis*, caught at the same time, were free from the infection. Early in June, the number and size of the parasites in a host body were rather small and only a small number of spores could be recognized in the fresh state with the addition of potassium hydrate solution. The growth of the parasite was rather remarkable during the hot weeks in the latter part of June and July so that every fish caught on July 17th showed a heavy infection, exhibiting small whitish pustules over the surface of the organ. During June, vegetative forms and spores were found in the lumen of the urinary tubules, altho some contained the parasitic masses in the tissue. About the middle of July, the parasite forms conspicuous cysts in the tissue thruout the organ. The cyst may or may not be covered by a thick layer of connective tissue from the host. Aside from this hypertrophy, the host did not show any pathological change which could be recognized.

Vegetative form: Youngest trophozoite found in the urinary tubule is multinucleate, rounded, and of from 20 to 50μ in diameter. The protoplasm is not differentiated, the entire body is finely granular or coarsely reticular in structure. In the protoplasm are to be seen nuclei and sporoblasts at different stages of development. The union of two propagative cells similar to that of *Myxobolus toyamai* produces a small body which developes into a single sporoblast and ultimately into a single spore (Figs. 605-613). In later stages, the trophozoite reaches a size of 200μ in diameter showing many stages of spore formation and mature spores, surrounded by thick layers of connective tissue from the host. Polysporous.

Spore: Elongated oblong with pointed anterior and truncated posterior extremities. The width is often greatest at the middle of the polar capsules, the posterior portion is much narrower than the anterior. Nearly circular in the cross-section thru the polar capsules. The shell is thin, the sutural line being faintly marked in fresh state. It generally is obliquely located in relation to the capsules. The shell also shows fine longitudinal striations, 14 to 16 in number, on each valve. The sutural line as well as the striations are best seen in spores stained with Heidenhain's iron hematoxylin. Two polar capsules elongated pyriform, mostly equal in size, occupy the anterior half of the spore. Abnormal situations of the polar capsules are sometimes observed (Fig. 619). The coiled polar filament is faintly visible in fresh spores. It is spirally coiled along the wall of the polar capsule without any central axis. This fact was clearly observed in stained section as is shown in Figs. 620 and 621. The filament has seven or eight windings, thus agreeing with the actual length of the extruded polar filament. The polar filament was extruded under the action of potassium hydrate solution. The extrusion takes place even in some spores which were treated with Schaudinn's fixative and kept in 95 per cent alcohol for three months (see the similar observations on *Myxobolus discrepans* on page 157). The sporoplasm is finely granular and transparent. When stained, it shows two nuclei in the center or near the posterior part of the body. Dimensions of preserved spores: length 15 to 17μ, breadth 5 to 6μ, thickness 4.5 to 5.5μ, polar capsule 7.5μ by 2μ, length of polar filament 40 to 50μ.

Suborder SPHAEROSPOREA nom. nov.

The definition of the suborder is recorded on page 57.

Family CHLOROMYXIDAE Thélohan

1892	*Chloromyxidées*	Thélohan	1892 : 173
1895	*Chloromyxidées*	Thélohan	1895 : 344

The characters of the family are described on page 57.

Genus CHLOROMYXUM Mingazzini

1890	*Chloromyxum*	Mingazzini	1890 : 160
1892	*Chloromyxum*	Thélohan	1892 : 173–176
1895	*Chloromyxum*	Thélohan	1895 : 344

The characters of the genus are described on page 57.
Type species: *Chloromyxum leydigi* Mingazzini.

CHLOROMYXUM LEYDIGI Mingazzini
[Figs. 108 to 113]

1851		Leydig	1851 : 225–234
1852		Leuckart	1852 : 435
1854		Lieberkühn	1854 : 352
1890	*Chloromyxum leydigi*	Mingazzini	1890 : 160–164
1892	*Chloromyxum leydigi*	Thélohan	1892 : 166, 169–170
1894	*Chloromyxum leydigi*		
	Chloromyxum incisum	Gurley	1894 : 259–260
1895	*Chloromyxum leydigi*		
	Chloromyxum incisum	Thélohan	1895 : 345–346
1898	*Chloromyxum leydigi*	Doflein	1898 : 292, 310, etc.
1912	*Chloromyxum leydigi*	Erdmann	1912 : 149–162
1916	*Chloromyxum leydigi*	Georgévitch	1916a : 3
1917	*Chloromyxum leydigi*	Davis	1917 : 236–237
1917	*Chloromyxum leydigi*	Erdmann	1917 : 276–321
1918	*Chloromyxum leydigi*	Georgévitch	1918 : 182–189

Habitat: Gall-bladder of *Rhina squatina* L., *Spinax spinax* L., *Scyllium canicula*, *S. asterias*, *Raja batis* L., *R. clavata* L., *R. undulata* Lac., *Torpedo narce* Ris., *T. marmorata*, *T. ocellata*, *T. torpedo* L., *Acanthias acanthias* L., *Trygon pastinaca* L., *Dasybatis hastatus*, *D. sabina*, *Pteroplatea maclura* Le Sueur, *Scoliodon terrae-novae*, *Cestracion zygaena*, *C. tiburo*, *Carcharhinus limbatus*; Roscoff, Concarneau, Marseille, Banyuls, Rovigno, Heligoland, Beaufort, Monaco (May), Napoli, Genova. Erdmann observed the species at Naples from March to August. She noticed mixed infection with *Ceratomyxa reticulata* and especially with *Leptotheca parva*. Georgévitch studied the parasite at Monaco from February to April.

Vegetative form: Polymorphous, being spherical, oval or irregular. The change of the form rather rapid under favourable conditions. Differentiation of protoplasm distinct. Ectoplasm with pseudopodia of various form, i.e., lobose, filiform or intermediary; short, pointed or branched. Endoplasm alveolar, filled with yellowish granules. Doflein observed the plasmotomic multiplication of young trophozoites. Polysporous. Erdmann's observations (1917) may be summarized as follows: Ameboid.

Color of the body greenish to dark green. The protoplasm is clearly differentiated into ectoplasm and endoplasm. The ectoplasm is hyaline and covers the entire surface of the body. It appears as a fine fibrous structure when fixed with Bouin's solution. The endoplasm contains besides nuclei, two kinds of spherules; one smaller and yellowish "color-carriers" and the other larger and light to dark greenish reserve bodies. The color-carrier is in part composed of myelin, while the reserve body is of glycogenous nature. The infection was studied experimentally *per os:* young trophozoites appeared in 3 to 5 days which continued to 10th day, various trophozoites were seen in 13 to 19 days, and sporulating individuals were first recognized in 39 days after the infection. The trophozoite multiplies in number either by fission or by budding. It usually contains enclosures which seem to be degenerating erythrocytes. Mictosporous.

Spore: Ovoidal. Shell-valves show wide edge at sutural plane, which is attenuated at the anterior end and forms a quadrilateral process at the posterior end, from which a row of cilia grows. Shell-valves have ridges (6 to 7), which run parallel to the posterior margin. The striations may vary considerably. Four polar capsules at the anterior end. Dimensions: length 8μ. Erdmann gave the following dimensions: Spores from *Torpedo marmorata* and *T. ocellata:* length 6 to 9μ, breadth 5μ, polar capsule 3μ by 2μ. Those from *Scyllium asterias:* length 8 to 9μ, breadth 6μ, polar capsule 2μ by 1μ. Those from *Raja batis:* length 7 to 8μ, breadth 5μ, polar capsule 2μ by 1μ. Length of polar filament 20 to 30μ (absolute alcohol warmed up to 40° C.).

CHLOROMYXUM CAUDATUM Thélohan

[Fig. 114]

1895	*Chloromyxum caudatum*	Thélohan	1895 : 346

Habitat: Gall-bladder of *Molge cristata* Laur.; Vicinity of Rennes.

Vegetative form: Body yellowish with lobose pseudopodia. Protoplasm finely granular.

Spore: Oval or spheroidal. Shell enlarged at the anterior part, having a simple or bifurcated tail-like process, as in Henneguya, at the posterior end. Dimensions: total length 18μ, length 8μ, breadth 6 to 7μ, length of tail 10μ.

CHLOROMYXUM QUADRATUM Thélohan

[Figs. 115 to 117]

1891		Pfeiffer	1891 : 111
1893		Pfeiffer	1893 : 81
1895	*Chloromyxum quadratum*	Thélohan	1895 : 347
1912	*Chloromyxum quadratum*	Parisi	1912 : 289
1913	*Chloromyxum quadratum*	Awerinzew	1913a : 155
1913	*Chloromyxum quadratum*	Fermor	1913 : 199

Habitat: Muscle of *Syngnathus acus* L., *Trachurus trachurus* L., *Nerophis aequorens* L., *Callionymus lyra* L., *Coris julis* L., *Ariodes polystaphylodon*, kidney of *Blennius gattorugine* Brunn; Helder, Roscoff, Concarneau, Marseille, Beira (Africa), Napoli (summer).

Vegetative form: Not described by any of these authors.

Spore: Quadrangular pyramid with curved edges and roundish angles. Four polar capsules at the anterior end. Dimensions: length 6μ, breadth 5μ, length of polar filament 8 to 10μ.

CHLOROMYXUM FLUVIATILE Thélohan

[Fig. 118]

1892	*Chloromyxum fluviatile*	Thélohan	1892 : 173–176
1895	*Chloromyxum fluviatile*	Thélohan	1895 : 346

Habitat: Gall-bladder of *Leuciscus cephalus* L.; Paris.

Vegetative form: Young trophozoites colorless; adults yellowish. Form highly variable. Active change of the form of body. Clear differentiation between ectoplasm and endoplasm. Ectoplasm usually recognizable at one end of the body where lobose pseudopodia are formed. Size reaches 25 to 30μ. Polysporous.

Spore: Spherical, generally small. Sutural ridge fairly well marked. Dimensions: 7 to 8μ in diameter.

CHLOROMYXUM MUCRONATUM Gurley

[Figs. 119 to 122]

1854		Lieberkühn	1854 : 352–353
1879		Leuckart	1879 : 248
1882		Bütschli	1882 : Pl. 38 : 17
1883		Balbiani	1883 : 201, 203
1893	*Chloromyxum mucronatum*	Gurley	1893 : 419
1894	*Chloromyxum mucronatum*	Gurley	1894 : 264, 265
1908	*Chloromyxum mucronatum*	Auerbach	1908 : 456
1909	*Chloromyxum mucronatum*	Auerbach	1909a : 71

Habitat: Urinary-bladder and kidney of *Lota lota* L.; Bodensee, other localities not mentioned.

Vegetative form: Spherical, elliptical or irregular. Size up to 75μ in diameter. Protoplasm containing irregularly scattered fat-like globules.

Spore: Sharp-contoured; subglobular, mucronate anteriorly. Dimensions: length 8μ.

CHLOROMYXUM DIPLOXYS (Gurley) Thélohan

[Figs. 123 to 125]

1866		Balbiani	1866 : 600–602
1867		Balbiani	1867 : 275, 276, 335
1882		Bütschli	1882 : 590
1890		Pfeiffer	1890 : 559
1892		Henneguy et Thélohan	1892 : 587
1893	*Cystodiscus ? diploxys*	Gurley	1893 : 411
1894	*Cystodiscus ? diploxys*	Gurley	1894 : 281
1895	*Chloromyxum diploxys*	Thélohan	1895 : 347

Habitat: Abdominal cavity of *Tortrix viridana* L. (imago);

Vegetative form: Trophozoites form spherical cysts, 230 to 400μ in diameter. Cyst membrane rather thick. Protoplasm containing brownish granules, and fat-like globules (red with iodine).

Spore: Elliptic or slightly flattened. Sutural line straight, forming a ridge. Two polar capsules at each end.

CHLOROMYXUM PROTEI Joseph

1905	*Chloromyxum protei*	Joseph	1905 : 450–451
1907	*Chloromyxum protei*	Joseph	1907 : 398–412

Habitat: Renal tubules of kidney of *Proteus anguineus* L.; Vienna.

Vegetative form: Generally rounded or sausage form. No clear differentiation between ectoplasm and endoplasm. Movements slow. Probable occurrence of plasmotomy by budding and division. Size: 40 to 45μ by 28 to 40μ.

Spore: Spherical. Shell finely striated parallel to the sutural line. Four polar capsules each with an independent opening. Dimensions: 10 to 13μ in diameter, polar capsules 4 to 6μ long. The polar filament appears to be rather short.

CHLOROMYXUM TRUTTAE Léger

[Fig.126]

1906	*Chloromyxum truttae*	Léger	1906 : 267–270

Habitat: Gall-bladder and gall-duct of *Trutta fario* L.; Dauphiné.

Vegetative form: Ameboid form. Elongated. Form resembles an *Amoeba limax* of about 40μ in length. Roundish or irregularly contoured, with small pseudopodia. Ovoidal or spherical, 25 to 40μ in diameter without any visible pseudopodia (resting state). Body colorless, clear and hyaline. Very active movements which last for several hours after the death of the host. Broad and obtuse pseudopodia well developed at the anterior end of the body. Endoplasm alveolar, contains variable numbers of nuclei, which are seen *in vivo*, refractive bodies and chromatic granules. Monosporous(?) and polysporous.

Spore: Spherical. Four polar capsules of different size. Shell-valves marked with parallel ridges. Dimensions: 8 to 9μ in diameter.

CHLOROMYXUM CRISTATUM Léger
[Figs. 127 and 128]

1906	*Chloromyxum cristatum*	Léger	1906 : 270–272

Habitat: Gall-bladder of *Tinca vulgaris* Cuv.; Grenoble.

Vegetative form: Ordinarily massive, with oval or round contours, without noticeable pseudopodium. Ectoplasm hyaline. Endoplasm granular and colorless. Average diameter of the adults about 20μ. Monosporous, rarely disporous.

Spore: Spherical or subspherical. Ten marked ridges run anteroposteriorly on each shell-valve, so that it presents a cog-wheel form in cross section. Four polar capsules at the anterior end, one pair being smaller than the other. Sporoplasm with two nuclei. Dimension: 10 to 11μ.

CHLOROMYXUM DUBIUM Auerbach
[Figs. 129 to 133]

1908	*Chloromyxum dubium*	Auerbach	1908 : 456–459
1910	*Chloromyxum dubium*	Auerbach	1910c : 177

Habitat: Gall-bladder of *Lota vulgaris* Cuv.; Bodensee (April to September).

Vegetative form: Spherical or rounded. Rarely irregular forms. Protoplasm is differentiated distinctly into ectoplasm and endoplasm. Ectoplasm very thin, forms pseudopodia which move slowly. Endoplasm granular, contains fat globules. Majority of the trophozoites appear to live floating in the bile, while some are attached to the epithelium of the bladder. Disporous and polysporous.

Spore: Spherical, with four polar capsules. Each shell valve has longitudinal ridges, variable in number (6 ridges are found on the drawing), which run parallel to the sutural line. Four polar capsules of nearly same size and convergent. Sporoplasm finely granular with two nuclei. Dimensions: diameter 10.8μ, length of polar capsule 3.6μ.

CHLOROMYXUM sp. Awerinzew
[Fig. 134]

1908	*Chloromyxum* sp.	Awerinzew	1908 : 43, 47, 48

Habitat: Gall-bladder of *Raja radiata*; Murman coast?.

Vegetative form: Form rounded. The protoplasm is distinctly differentiated into ectoplasm and endoplasm. Ectoplasm hyaline and comparatively abundant in quantity compared with endoplasm, forms lobose pseudopodia of active movements. Endoplasm vacuolated, contains enclosures. Between the two layers, a thin layer of protoplasm, reticular in structure and stained deeply with hematoxylin, is present.

Spore: No figure.

CHLOROMYXUM THYMALLI Lebzelter

1912 ***Chloromyxum thymalli*** **Lebzelter** **1912 : 295–296**

Habitat: Gall-bladder of *Thymallus thymallus* L.; Vienna?

Vegetative form: Irregular form, 33 to 35μ long in average. Endoplasm contains fat globules which stain brown with carmine. Trophozoites attached to the epithelium. In average, 6 spores formed in each individual. Intracellular stage in the epithelial cell is supposed. Polysporous.

Spore: Spherical. Shell structure similar to *C. protei*, but ridges are more developed and exhibit somewhat wavy courses. Polar capsules of equal size. Dimensions: 9 to 9.5μ in diameter, polar capsules 3μ.

CHLOROMYXUM KOI Fujita

[Fig. 135]

1913 ***Chloromyxum koi*** **Fujita** **1913 : 257–259**

Habitat: Gall-bladder of *Cyprinus carpio* L.; Sapporo (Nippon).

Vegetative form: Spherical, with greatest diameter up to 50μ, containing 1 to 3 spores. Each spore is situated in a clear space surrounded by a membranous envelope (sporoblast?), around which there is some finely granular matter (endoplasm?).

Spore: Spherical, exhibiting a somewhat angular contour at the anterior end. Shell thick and has well marked ridges on the surface, i.e., 4 to 5 circular ridges and on both sides of these ridges, two more ridges each bent in a loop-like manner, so that the outline of spore in cross section, is very much like of a toothed wheel with nearly equidistant teeth, 16 to 18 in number. Four polar capsules, two slightly larger than the other two. Dimensions: length 16μ, breadth 10μ, length of polar capsule 4μ, length of polar filament 64μ.

CHLOROMYXUM MAGNUM Awerinzew

[Figs. 136 to 138]

1913 ***Chloromyxum magnum*** **Awerinzew** **1913 : 155–156**

Habitat: Gall-bladder of *Acanthias blainvillei*;* Algoa Bay, East London, Lüderitzbucht (Africa).

Vegetative form: Ameboid. Body yellowish by the presence of large yellowish granules in endoplasm. Often round or rosary form. Pseudopodia sometimes absent, so that the trophozoites move like *Amoeba limax* with a cluster of small, hairy pseudopodia at the posterior end. In larger form, small round pseudopodia, composed of homogeneous ectoplasm, are formed. Plasmotomy by budding, was often observed. Usually polysporous, rarely monosporous.

Spore: Elongated spherical form. Four polar capsules at the narrow, anterior end. Sporoplasm with two nuclei. Dimensions: length 40 to 48μ, breadth 30 to 38μ, length of polar capsules 12 to 15μ.

*** Misprinted in Awerinzew's paper as *blainvilei*.**

CHLOROMYXUM FUNDULI Hahn
[Figs. 139 and 140]

1915 *Chloromyxum funduli* Hahn 1915 : 205–206

Habitat: Muscle of *Fundulus* sp.; Woods Hole. In one fish.

Vegetative form: Hahn made observations on few fresh and stained smears. According to him, it is clear that the staining was abnormal. It is hard to quote this here as he used different terms without giving any definition. The reader is advised to consult Hahn's paper.

Spore: Form slightly resembles that of *Choloromyxum quadratum*. Posterior end rounded, the anterior portion narrow and truncated at the tip; optical cross-section thru the posterior part of the polar capsules, circular. Four polar capsules at the anterior end. Dimensions: height (length) 6μ, breadth and thickness 7.5μ respectively.

Remarks: As to the comparison of the present species with *Chloromyxum clupeidae* Hahn, see p. 94.

CHLOROMYXUM MISGURNI Kudo
[Figs. 141 to 146]

1916 *Chloromyxum misgurni* Kudo 1916 : 6–7

Habitat: Gall-bladder of *Misgurnus anguillicaudatus* Cantor; Tokio (September).

Vegetative form: Round or irregular. Semicircular when viewed from side. From the flat surface, many fine root-like, filiform pseudopodia are extruded. No clear differentiation between ectoplasm and endoplasm. Endoplasm alveolar. Trophozoites always found attached to the lining epithelial cells. Size up to 50μ by 20μ. Polysporous (6 to 8 spores), rarely disporous.

Spore: Spherical, slightly attenuated at the anterior end. Sutural line straight and forms a ridge. Fine longitudinal striations run parallel to the sutural line. Four polar capsules at the anterior end. Sporoplasm finely granular, has two nuclei of equal size. Dimensions: length 8 to 9μ, breadth 6 to 7μ, thickness 5 to 6μ, length of polar capsule 2 to 3μ, of polar filament 28 to 35μ (KOH).

Remarks: The host is often infected at the same time by *Chloromyxum fujitai*, the trophozoites of which can be distinguished from the present form by the structure and the floating habit in the bile. Spores in the two species are decidedly different in form, structure and size.

CHLOROMYXUM FUJITAI Kudo
[Figs. 147 to 152]

1916 *Chloromyxum fujitai* Kudo 1916 : 7–9

Habitat: Gall-bladder of *Misgurnus anguillicaudatus* Cant.; Tokio, (5% of the fish examined in September, found infected).

Vegetative form: Round or irregular. No clear differentiation of protoplasm. Endoplasm highly vacuolated. Ectoplasm being hardly distinguishable. Size up to 40μ in diameter. Trophozoites float in the bile in almost all cases. Disporous and polysporous (up to 8 spores).

Spore: Spherical, often attenuated at the anterior end. Sutural line not straight. Shell very thick, shows thick ridges running longitudinally on the surface. In optical cross section, the spore presents an outline like a cog-wheel with 20 to 22 ridges. The thickness of ridges varies regularly; the thickest ones being located on two lines where a plane perpendicular to sutural plane cuts the shell longitudinally, others decreasing in thickness as they approach the sutural line. Four polar capsules at the anterior end. Sporoplasm with two nuclei. Dimensions: length 10 to 12μ, breadth 8 to 10μ, polar capsules 2 to 3μ, length of polar filament 23 to 30μ (KOH).

CHLOROMYXUM CLUPEIDAE Hahn

[Figs. 153 to 156 and 562 to 565]

1900	Sporozoa	Tyzzer	1900 : 66–68
1901	Sporozoa	Linton	1901 : 438
1910	*Chloromyxum* sp.	Auerbach	1910 : 178
1917	*Chloromyxum clupeidae*	Hahn	1917 : 13–19

Habitat: Body musculature of *Clupea harengus*, *Pomolobus pseudoharengus*, *P. aestivalis*, *P. mediocris*, *Brevoortia tyrannus*, *Stenotomus chrysops*, *Tautogolabrus adspersus*; Woods Hole.

Tyzzer mentioned in his paper and also in a letter to the writer that he collected the material in August of 1900 and that he found the infection occurred only among young fish. Hahn also called attention on the latter fact.

Vegetative form: Hahn's observations are as follows:

Clusters of spores ("pseudocysts") are spindle-shaped, especially when young, usually lying between the bundles of muscle fibres. Color white or creamy. Larger ones usually "in pocket just beneath the integument." Schizogonic multiplication probably exists. Parasites hard to stain, anilin dyes being unable to stain at all. Large form (probably composed of many individuals) 890μ by 30μ.

Tyzzer described as follows: Cysts up to 1 to 2 mm. in length, lying between the muscle fibres of the myotomes, surrounded at times by membraneous connective tissue. The parasites also occur in diffused infiltration.

Linton found two cysts, 1.74mm. by 1.16mm. and 1.16mm. by 0.58mm. and also diffused state between the fibrillae.

The writer's observation on slides prepared by Dr. Tyzzer* is as follows: Two cysts in sections; one almost spherical, 480μ by 430μ, sur-

*The writer had recently the opportunity of examining the slides of the parasites prepared by Dr. Tyzzer, which occasion he appreciated very much. As a result of this, the writer became convinced of the identity of forms observed by Tyzzer, Linton and Hahn, tho he could not examine the latter authors' specimens.

rounded by several layers (about 10μ thick) of connective tissue of the host, the other oval, 120μ by 110μ. The staining sufficed to reveal only indistinct structure of the parasites. The homogeneous ectoplasm surrounds the entire surface of the body as a uniform, but very thin layer. Endoplasm granular, filled with spores of remarkably identical stages of development. Isolated spores, also, occur in the muscle bundle in the state of diffused infiltration. Polysporous.

Spore: Hahn describes it as follows: Low conical pyramid with round base; square with bulging sides. No indication of valves in the spore shell. Dimensions: height (length) 5μ, breadth and thickness 7μ, polar capsule 2μ by 1μ.

Linton's form: squarish in outline with rounded corners, 7μ in diameter.

Tyzzer describes his form as follows: Quadrilateral in anterior end view; oval in side view. The four corners are a little protuberant and are directed slightly forward. Shape varies considerably in different species of host. The corners of the spore from *Stenotomus chrysops*, are greatly drawn out, exhibiting stellate form. Four polar capsules radiating from the anterior extremity toward the four corners. Shell shows four furrows radiating from the anterior extremity outwards to the side. Sporoplasm occupies extracapsular cavity. Polar filaments are extruded under the action of acetic acid. Dimension: breadth 7 to 7.5μ.

The writer's observations are as follows:

Spores in fixed and decolorized smears. In smear, most of the spores are seen lying on the base exposing the anterior end view toward the observer's eyes, a few lying with the sutural diameter parallel to the surface of the slide. Form quadrilateral with corners more or less drawn out in anterior end view; oval, with concave posterior side in front view (Figs. 562 to 564). Shell apparently thin but was not clearly separated from the sporoplasm which is finely granular and fills the extracapsular cavity of the spore. Four polar capsules of nearly same size and pyriform. Coiled polar filament indistinct. When stained, the polar capsules stained deeply. It is remarkable to see almost all of the spores exhibit four deeply stained nuclei of capsulogenous cells, which in ordinary case disappear as the spore matures. Dimensions: height (length) 4 to 4.75μ, breadth and thickness 5.4 to 6.5μ, polar capsule about 1.5μ by 0.75μ.

Remarks: Thus the forms of Tyzzer, Linton and Hahn had better be treated as one and the same species. As to the distinction of *Chloromyxum funduli* and the present species, the writer is unable to make it clear as he could not examine the preparation of the former species and especially as he observed some intermediate forms between these two forms in Dr. Tyzzer's preparations of the present species.

CHLOROMYXUM GRANULOSUM Davis

[Figs. 157 and 158]

1917	*Chloromyxum granulosum*	Davis	1917 : 237.

Habitat: Urinary bladder of *Tylosurus marianus*; Beaufort (July, August).

Vegetative form: Elongated when first placed on the slide, but soon becomes contracted and motionless; progressing by very slow ameboid movements. Ectoplasm usually undistinguishable, being noticed only in a few individuals which had formed one or two short, lobose pseudopodia of hyaline ectoplasm. Body colorless to light yellow. After being on the slide for some time rounded trophozoites often became surrounded by a distinct ectoplasmic layer. Entire body usually coarsely granular, the granules varying greatly in size and shape; sometimes indistinctly vacuolated. Fat globules also present. Size of rounded trophozoites about 30μ. Disporous and polysporous.

Spore: Spherical, with four distinct ridges on the posterior half of each valve converging toward the anterior end. Sutural ridge distinct. Polar capsules pyriform and convergent. Dimensions: diameter 7μ, polar capsules 2μ.

Remarks: Trophozoites from some fish were all colorless, while the larger trophozoites from others were distinctly yellow.

CHLOROMYXUM TRIJUGUM nov. spec.

[Figs. 159 to 182]

Habitat: Gall-bladder of *Lepomis megalotis* Raf.; Stony Creek, and Homer Park, Ill. (November). The parasite was only found in this species, *Lepomis humilis* and *L. cyanellus* seined at the same time being free from the infection. Six specimens, three from each of the above mentioned localities, harboured abundantly both free spores and trophozoites of various stages of development in the bile. The fish, from 6.5 to 10.5cm long, were normal in external appearance and the bladders did not show any particular abnormality, compared with those of other fish, as is usually the case.

Vegetative form: Trophozoites float usually free in the bile, younger forms are most frequently attached to the epithelium of the bladder. Form extremely polymorphous, manifesting various shapes such as, almost circular, rounded, oval, elongated or irregular, which is chiefly due to the active extrusion and retraction of the pseudopodia from the body surface. Body is highly transparent and colorless in both the young and the adult. The differentiation of protoplasm into ectoplasm and endoplasm, is distinctly visible in vivo as well as in stained preparations, especially in larger forms (Figs. 159 to 165). The endoplasm presents an alveolar structure without any enclosure except the nuclei and various stages of spore formation (Figs. 161, 165, 168 to 171), the alveolar network being smaller at the periphery than in the center. The ectoplasm is a hyaline, transparent and homogeneous layer, free from any course granulation in fresh conditions. It shows, however, a very fine reticular structure in stained preparations. The pseudopodia are of two kinds in form, always, formed of ectoplasm alone: the filose and bristle-like form, sometimes branching and protruding from the entire surface or from a localized part of the body, vary in length from 0.5 to 4μ according to the size of the individual (Figs. 159, 161, 164). This form developed, sometimes, into a thicker form with two to four branched finer processes. The blunt, lobose pseudopodium formed at a localized part of the body is well recognizable in larger individuals. Frequently the filose and the lobose pseudopodia are formed on a trophozoite at the same time. The movements of the blunt pseudopodia were striking in some specimens. At the beginning of the observation, ten minues after the bile was removed from the host, two club-shaped pseudopodia (Figs. 161 to 163) which were extruded from a trophozoite, the largest diameter of which being 20μ, moved very actively in the semicircular area changing their forms, showing maximum length of 20μ. In about thirty minutes, they were retracted and from the same place, a short, oval-shaped pseudopodium was seen to be extruded, which remained in the same position for some time without great change of form (Fig. 164). In another case, a trophozoite with a very broad and rounded pseudopodium extruded actively two to three rounded smaller processes at its extremity (Figs. 165 to 167). After fifteen minutes the pseudopodium was retracted, the ectoplasm forming a uniformly thick layer around the endoplasm. The observations were done at room temperature in hanging drop preparations, sealed with vaseline and paraffin, by using comp. oc. 12 and apo. imm. ob. 2mm., which caused no mechanical pressure upon the parasites. The change of form and especially that of pseudopodia, was clearly observed for one hour and twenty minutes under the above mentioned conditions after the bile was removed from the host. The trophozoites when kept for sixteen hours at room temperature, underwent degeneration and disintegrated, setting free the spores which were formed in them.

No active multiplication by plasmotomy, was observed in vivo. In fixed prepartions, however, forms that suggested the occurrence of the process in the present myxosporidian, were recognized. As was stated before, the pseudopodia are always formed of the ectoplasm and as each portion of these dividing forms has many nuclei, the author is inclined to record the presence of plasmotomy in the present form.

Size varies greatly. The monosporous form 10μ by 14μ, disporous 15μ by 25μ and polysporous 30μ by 50μ, the largest individual, developing and containing more than 200 spores, was 300μ by 50μ.

Spore: Generally circular in front view; oval in side view. Shell comparatively thick, consequently the coiled polar filament is frequently indistinct. Sutural ridge straight and distinct. Each valve has a thick straight, sometimes slightly zigzag-form ridge that runs parallel to the sutural line, so that in side view, three distinct ridges encircling the spore are recognized (Figs. 177 and 180). From each of these two ridges, eight to twelve short ridges are directed toward the center of each valve, which can distinctly be observed on the spores stained with Heidenhain's iron hematoxylin (Figs. 179 and 180). They can be seen as faint markings rising from the margin directed toward the center of the spore, in front view of fresh spores. Four pyriform polar capsules of slightly different size open their foramina independently at the anterior end of the spore (Figs. 178 and 181). The sporoplasm, granular and finely reticular, shows almost always two nuclei when stained. Dimensions in vivo: length and breadth 8 to 10μ, thickness 5 to 7μ, polar capsules 3 to 5μ by 2 to 3μ, length of polar filament 32 to 40μ (H_2O_2, KOH).

Remarks: In carefully made smear of the bile, a number of empty spores which had been seen in fresh hanging drop preparations, and often spores, in which the sporoplasm with two elongated nuclei seemed to leave the shell (Fig. 182), were recognized. As this particular spore was found close to a thicker mass of the wall of the gall-bladder in the smear, it can hardly be thought that the mechanical pressure during the preparation lead to the mission of the sporoplasm from the spore. It is possible, on the other hand, to think that this is one of the cases of the germination of the spore in the host in which they were developed, as was reported by the author in *Nosema bombycis* Nägeli (Kudo, 1916).

CHLOROMYXUM CATOSTOMI nov. spec.
[Figs. 560 and 561]

Habitat: Gall-bladder of *Catostomus commersonii* Lac.; Salt Fork, Urbana, Ill. (October). Four fish, from 8 to 14cm.; apparently normal.

Vegetative form: Form usually rounded, with filiform pseudopodia. Majority attached to the epithelium, a few being free in the bile. Body colorless. Protoplasm is not well differentiated. Endoplasm occupying the entire body is of granular structure with vacuoles and refringent spherules. Size: from 15 to 35μ. When kept for 16 hours in a refrigerator, the trophozoites liberated the spores. The number of spores in each trophozoite is usually 2 or 3, rarely 5 to 6. Active plasmotomic multiplication observed when examined. Spores were comparatively small in number, while the trophozoites were attached abundantly to the epithelium of the gall-bladder. Disporous and polysporous.

Spore: Form approximately spherical in front view; oval in profile. Shell with very fine striations which run parallel to the sutural ridge that is fairly well marked. Rounded polar capsules almost of same size, have independent openings at the anterior end. Coiled polar filament indistinct. Abnormal spores with five polar capsules are sometimes seen. Dimensions of fixed spores: length 8μ, breadth 7μ, thickness 5 to 6μ, polar capsules 2 to 2.5μ by 1.5μ.

CHLOROMYXUM WARDI nov. spec.
[Figs. 632 to 642]

Habitat: In the gall-bladder of *Oncorhynchus nerka*: Klutina Lake, Alaska (August). A single gall-bladder collected and preserved in formol by Professor Ward, was found to harbor the present species. The study was done on preserved material and on stained smear preparations.

Vegetative form: Young trophozoites (Fig. 632) show ameboid form, and are mostly multinucleated. The protoplasm is not well differentiated either in unstained material or in stained specimens. It is granulated thruout the body, and is vacuolated at places. The smallest form measured was 18μ in largest diameter. The shape of the body suggests its possession of ameboid movements when alive, altho the writer could not examine fresh specimens. Large trophozoites in which the spore formation had partly been completed are generally rounded with reticular protoplasm. Size varies to some extent. The trophozoite shown in figure 633 contains six mature spores and is 23μ in largest diameter. The largest one found was 38 by 30μ, showing ten spores and nuclei. Each spore appears to develop independently from a single sporoblast. Disporous and polysporous.

Spore: Rounded pyramidal in front view (Figs. 640 and 641); circular in transverse section (Fig. 638). The shell is thickened near the posterior margin (Figs. 640 and 641). Sutural line is not straight, the ridge being fairly distinct. The striations on the shell vary to a considerable extent (Figs. 634 to 637 and 639). Four polar capsules at the anterior end, mostly unequal in size and shape. The coiled polar filament is invisible in formol material. Potassium hydrate solution does not cause its extrusion in the preserved spores. The sporoplasm is finely granular with two nuclei. Dimensions of unstained preserved spores: diameter 7.5 to 9μ, polar capsule 3 by 2.5μ.

Remarks: The writer was able to study forty specimens of gall-bladder of Alaskan fishes, chiefly of salmon, which have been collected by Professor Henry B. Ward, during the summer of 1919, for which he wishes to express his deepest appreciation. The examination of these specimens showed that myxosporidia were found only in one of the gall-bladders, and that specimen presented a fairly heavy infection of the present species.

Family SPHAEROSPORIDAE Davis

1917 *Sphaerosporidae* Davis 1917 : 219

The characters of the family are described on page 57.

Genus SPHAEROSPORA Thélohan

1892	*Sphaerospora*	Thélohan	1892 : 167

The characters of the genus are described on page 57.

Type species: *Sphaerospora divergens* Thélohan.

SPHAEROSPORA DIVERGENS Thélohan

[Figs. 183 to 186]

1895	*Sphaerospora divergens*	Thélohan	1895 : 339–340
1912	*Sphaerospora divergens*	Parisi	1912 : 289
1912	*Sphaerospora divergens*	Auerbach	1912 : 41–42

Habitat: Urinary tubules of kidney of *Blennius pholis* L., *Crenilabrus melops* L., *C. pavo* Cuv. et V, and urinary bladder of *Hippoglossoides limandoides*; Concarneau, Roscoff, Napoli (July), Smalfjorden.

Vegetative form: Rounded discoidal or spherical or more or less elongate. Ectoplasm transparent, without real pseudopodium. Movements extremely slow. Endoplasm, granular, contains fat globules and small yellowish granules. Size of sporulating individuals: 65μ by 55μ, 60μ by 25μ, 60μ by 20μ, etc. Polysporous (Thélohan); monosporous, and disporous (Auerbach).

Spore: Spherical. Shell with fine striations. Two polar capsules divergent; coiled polar filament visible in fresh state. Sporoplasm fills the extracapsular cavity of the spore. Dimensions: 10μ in diameter, often 10μ by 12μ, the larger diameter coinciding with sutural plane, thickness 8μ (Auerbach), polar capsules about 4μ long, length of polar filament 20 to 25μ.

SPHAEROSPORA ELEGANS Thélohan

[Figs. 187 and 188]

1890		Thélohan	1890 : 193–209
1892	*Sphaerospora elegans*	Thélohan	1892 : 167–175
1894	*Chloromyxum (Sphaerospora) elegans*	Gurley	1894 : 266
1895	*Sphaerospora elegans*	Thélohan	1895 : 338–339
1909	*Sphaerospora elegans**	Auerbach	1909a : 71
1912	*Sphaerospora elegans*	Parisi	1912 : 289

Habitat: Renal tubules of kidney, connective tissue of ovary and urinary bladder of *Gasterosteus aculeatus* L., *G. pungitus* L., *Lota vulgaris* Cuv., *Phoxinus laevis* L.; Paris, Bretagne, Karlsruhe, Lake Garda.

Vegetative form: Rounded or slightly elongated, not exceeding 20 to 25μ in diameter. Protoplasm homogeneous, very finely granular, contains numerous refractive globules, probably of fatty nature. Pseudopodia lobose. Movements slow. Disporous.

*Misprinted as *Sphaeromyxa elegans*.

Spore: Spherical, somewhat attenuated at the anterior end. Sutural ridge present, terminating in a small projection at each end of the spore. Two polar capsules spherical. Coiled polar filament not visible in fresh state. Dimensions: diameter 10μ in average, sutural diameter about 11μ.

SPHAEROSPORA ROSTRATA Thélohan
[Fig. 189]

1895	*Sphaerospora rostrata*	Thélohan	1895 : 339

Habitat: Malpighian bodies of kidney of *Mugil* sp.; Roscoff, Le Croisic, Le Vivier-sur-mer, Marseille, Banyuls.

Vegetative form: Not described.

Sphore: Subspherical. Shell shows deep longitudinal striations which end in sharp spinous edges at the posterior end. Sutural ridge well marked. Anterior part shows enlargement of quadrangular lamella, which is spinous in side view. Dimensions: 10 to 12μ in diameter, sutural diameter 1 to 2μ longer, length of polar filament 40μ.

Remarks: The parasites cause the degeneration of the Malpighian bodies.

SPHAEROSPORA MASOVICA Cohn
[Figs. 190 to 192]

1902	*Sphaerospora masovica*	Cohn	1902 : 628–632

Habitat: Gall-bladder of *Abramis brama* L.; Mauersee.

Vegetative form: Polymorphous, due to active movements. Transparent and colorless, while in motion. Endoplasm highly granular, contains yellowish enclosures. Ectoplasm hyaline, forms a narrow layer around the body, occasionally developing into a blunt lobose pseudopodium. Pseudopodia of two kinds; lobose and filose, also intermediate forms. Filiform pseudopodia are formed and retracted more slowly than the lobose. Plasmotomy is of probable occurrence. Two spores are formed in each pansporoblast. Size variable: 10μ (with no spore), 18μ (with sporoblasts), 29μ (with 4 sporoblasts), 38μ (with 22 sporoblasts). Disporous(?), polysporous.

Spore: Spherical. Sutural ridge well marked. Polar capsules and sporoplasm are comparatively small, the former convergent. By warming the spore, polar filament is extruded and at the same time two filaments ("starren Fäden") are made visible at the anterior part of the sutural plane. Sporoplasm with two nuclei, no vacuole being present. Dimensions: diameter 8μ, length of polar filament 38μ, length of sutural filament 14μ.

Remarks: Cohn did not observe free spores in the gall-bladder. He, however, saw many free spores, separated from each other, in the intestine, concluding that the body and pansporoblast membrane of trophozoites, are destroyed in the intestine, setting the spores free.

SPHAEROSPORA PLATESSAE Woodcock

[Figs. 193 and 194]

1904 *Sphaerospora platessae* Woodcock 1904 : 59–60

Habitat: Otic-capsule of *Pleuronectes platessa* L.; England.

Vegetative form: Cysts opaque masses about 1mm. in diameter. The cartilage was greatly hypertrophied. Polysporous (presumably).

Spore: Spherical. Shell unornamented. Two polar capsules. Sporoplasm with several refractive granules, but without any vacuole. Dimensions: diameter 8 to 9μ, length of polar filament about 70μ.

Remarks: Woodcock placed this species provisionally in the genus as he could not examine any fresh material, but had studied smears only.

SPHAEROSPORA ANGULATA Fujita

[Figs. 195 to 197]

1912 *Sphaerospora angulata* Fujita 1912 : 261–262

Habitat: Kidney of *Cyprinus carpio* L., *Carassius auratus* L.; Sapporo (Nippon).

Vegetative form: Only description: "The number of the spore in the sporoblast is in this case always less than in the others, rarely exceeding two."

Spore: Somewhat triangular, with convex sides, oval in sideview. Slightly pointed at the mid-posterior margin of the spore. Shell very thin, faintly marked with concentric striations. Two oblong polar capsules are of unequal size. Dimensions: length 7 to 8μ, breadth 6 to 7μ, thickness 5μ, length of largest polar capsule 3.8μ, length of polar filament twice as long as that of the spore.

SPHAEROSPORA POLYMORPHA Davis

[Figs. 198 and 199]

1917 *Sphaerospora polymorpha* Davis 1917 : 231–232

Habitat: Urinary bladder of *Opsanus tau*; Beaufort (June, July).

Vegetative form: Elongate, but never very irregular in shape. Slowly ameboid. Body colorless. Ectoplasm clearly seen in younger forms, forming one to several large lobate pseudopodia, which in turn extrude several short, conical pseudopodia. In larger forms, ectoplasm is, often, recognizable only at ends of pseudopodia, which in such cases are composed chiefly of endoplasm. Endoplasm granular, vacuolated in some smaller forms, but in larger individuals vacuoles are indistinct or absent; small fat globules abundant in large forms; numbers of rounded sporoblast cells can be distinctly seen. Size of large trophozoites 35μ by 50μ. Disporous and polysporous (polysporous forms rarely contain many spores at the same time).

Spore: Spherical, sometimes slightly compressed infero-superiorly. Sutural ridge; on each side are a number of concentric striations extending around each valve parallel to sutural line. Polar capsules pyriform and large. Coiled polar filaments indistinct. Sporoplasm finely granular. Dimensions: diameter 7 to 10μ, (8μ in average), polar capsules 4 to 5μ by 2 to 2.5μ.

SPHAEROSPORA sp. Davis

1917	*Sphaerospora* sp.	Davis	1917 : 213

Habitat: Urinary bladder of *Lepisosteus platystomus*; Gainesville, Fla.
Vegetative form: No description.
Spore: Not described.

SPHAEROSPORA sp. Southwell et Prashad

1918	*Sphaerospora* sp.	Southwell and Prashad	1918 : 347–348

Habitat: Under the scales of *Barilius barna*; from the vicinity of the Ruby Mines, Burma (June).

Vegetative form: The cysts occurred in very large numbers, one under each scale.

Spore: Authors' description: "The poor condition of the material did not allow of a complete account of its structure, but the bicapsulate, rounded structure of its spores places it undoubtedly in the genus Sphaerospora Thélohan."

SPHAEROSPORA CARASSII nov. spec.
[Figs. 200 to 204]

Habitat: Gill filament of *Carassius carassius* L.; Tokio (February).

Vegetative form: Trophozoites small ameboid in groups or in diffused condition in the connective tissue of the gill filament. No cyst formation. The number of trophozoites in groups is generally small. The largest group found in sections was 96μ by 36μ, the macroscopical examination always failing to trace the parasites. The trophozoites, 10 to 20μ long, with poorly differentiated protoplasm and usually reticular endoplasm without any particular enclosure (Fig. 200). Ameboid movements not observed. Schizogonic multiplication rapid, each of the daughter individuals developing into two spores. Disporous. Other sporous characters could not be determined.

Spore: Spherical in front and side views, tho form variable to some extent (Figs. 201–203). Shell smooth. Sutural ridge fairly distinct. Two polar capsules, broadly pyriform, of equal size and convergent, located at the anterior end, one on each side of the sutural plane. Coiled polar filament highly distinct (5 to 6 times) in vivo. Sporoplasm granular, shows two nuclei when stained; no vacuole of any nature. Dimensions in vivo: diameter 8 to 13μ, polar capsules 4 to 5μ by 2.5 to 3.5μ, length of polar filament 35 to 40μ (KOH or pressure).

Remarks: No species of the genus, has ever been found in the branchiae. The characters of the spore, however, compel the writer to place the form in the present genus.

Genus SINUOLINEA Davis

1917	*Sinuolinea*	Davis	1917 : 219

The characters of the genus are described on page 57.

Type species: *Sinuolinea dimorpha Davis.*

SINUOLINEA DIMORPHA Davis

[Figs. 205 to 213]

1916	*Sphaerospora dimorpha*	Davis	1916 : 333–377
1917	*Sinuolinea dimorpha*	Davis	1917 : 232–233

Habitat: Urinary bladder and ureter of *Cynoscion regalis*; Beaufort.

Vegetative form: Disporous and polysporous trophozoites differ distinctly from each other. Disporous trophozoites irregular, colorless, transparent and show slow movements. When attached to the epithelium, rounded with one to several pseudopodia. Differentiation of protoplasm distinct. Occasionally endoplasm contains one or more erythrocytes. Average diameter of full-grown form 25 to 30μ.

Polysporous form: when attached to the bladder epithelium, the free end is drawn out into a long, cylindrical process, covered with numerous short, hairlike ectoplasmic processes. While not movable, these processes are readily absorbed and reformed. When the trophozoite is detached from the epithelium, the larger end gives rise to numerous conical or arborescent pseudopodia, by means of which the trophozoite moves slowly. Endoplasm extends into the proximal portion of large pseudopodia. It is granular and vacuolated, contains numerous fat globules, refractive granules, yellowish crystals (hematoidin?) and erythrocytes in various stages of disintegration. Endoplasm also contains gemmules, each composed of outer layer and finely granular central portion. Size varies greatly: up to 575μ by 90μ.

Spore: Spherical. Sutural ridge well marked. Polar capsules large and spherical. Sporoplasm forms a rounded granular mass. Dimensions: diameter 15μ, diameter of polar capsules 4.5μ, length of polar filament 27 to 35μ.

SINUOLINEA CAPSULARIS Davis

[Figs. 214 to 216]

1917	*Sinuolinea capsularis*	Davis	1917 : 233

Habitat: Urinary bladder of *Paralichthys albiguttus*, *P. dentatus*, *Spheroides maculatus*; Beaufort (July, August).

Vegetative form: Rounded to irregular shape. Body colorless or light yellow. Progressive movements slow. Pseudopodia large branched or arborescent, formed entirely of ectoplasm. Ectoplasm transparent and usually granular, merging gradually with the endoplasm. Endoplasm contains numberous fat globules. In large trophozoites, gemmules are observed. The gemmules are more finely granular and more transparent than the surrounding protoplasm and are practically identical with the small, free trophozoites. Trophozoites containing several gemmules are usually rounded and motionless and appear to be more or less degenerate. Disintegration of such trophozoites were actually observed. Sporulating trophozoites were rare and were never seen to contain gemmules. Size up to 40μ in diameter. Disporous and polysporous(?).

Spore: Spherical, sometimes slightly elongated. Sutural plane much twisted on its axis. Sutural ridge very distinct. Polar capsules and capsulogenous cells large occupying more than one-half of the cavity of spore. Coiled polar filament distinct. Sporoplasm granular contains numerous fat globules. Dimensions: diameter 12 to 14μ, diameter of polar capsules 4.5μ, length of polar filament 50μ.

SINUOLINEA ARBORESCENS Davis

[Figs. 217 and 218]

1917	*Sinuolinea arborescens*	Davis	1917 : 233

Habitat: Urinary bladder of *Siphostoma floridae*; Beaufort

Vegetative form: Rounded or irregular. Body colorless or light yellow. Actively ameboid, forming large arborescent pseudopodia of ectoplasm. Ectoplasm well developed, hyaline and homogeneous. Endoplasm coarsely granular, sometimes containing a few fat globules. Larger trophozoites are less active and the ectoplasm less distinct. In sporulating trophozoites the ectoplasm may entirely disappear, the entire trophozoite consisting of a coarsely granular mass. Diameter of rounded sporulating trophozoites 75μ. Polysporous.

Spore: Rounded, in front view, slightly elongated in the anterior end view. Polar capsules large. Sutural ridge prominent, makes a characteristic S-shaped turn on the anterior end. Coiled polar filaments distinct. Dimensions: length 15μ, breadth 12μ, diameter of polar capsules 5μ.

SINUOLINEA OPACITA Davis

[Fig. 219]

1917	*Sinuolinea opacita*	Davis	1917 : 234

Habitat: Urinary bladder of *Paralichthys albiguttus*; Beaufort (August).

Vegetative form: Rounded or slightly irregular. Body colorless and opaque. Movements slow. Pseudopodia short lobose. Ectoplasm not distinct, except around ends of pseudopodia, where it forms a thin hyaline layer. Endoplasm opaque, finely granular, with numerous greenish-yellow fat globules varying greatly in size. Diameter of rounded sporulating trophozoites 22μ, exceptionally large trophozoites 100μ. Disporous.

Spore: Nearly spherical, with flattened, lateral appendages extending from the posterior side. Sutural plane slightly twisted on its axis. Sutural ridge distinct. Polar capsules large. Coiled polar filament distinct. Sporoplasm finely granular, containing several comparatively large fat globules. Dimensions: diameter 12 to 13μ, diameter of polar capsules 4μ.

SINUOLINEA BRACHIOPHORA Davis

[Fig. 220]

1917	*Sinuolinea brachiophora*	Davis	1917 : 234

Habitat: Urinary bladder of *Paralichthys albiguttus*; Beaufort (August only in one fish).

Vegetative form: Rounded to somewhat irregular. Body colorless. Ectoplasm hyaline. Endoplasm granular, with numerous large fat globules. Disporous.

Spore: Nearly spherical, with a long lateral appendage from each valve. These appendages are empty except at extreme distal end, which contains a granular mass, probably the remains of the parietal cell. Sutural plane slightly oblique to longitudinal axis. Sutural ridge distinct. Polar capsules and capsulogenous cells large, occupying more than half of cavity of spore. Sporoplasm finely granular. Dimensions: length exclusive of appendages 9 to 11μ, length of appendages 18 to 22μ, breadth of spore 9μ, diameter of polar capsules 3.5μ.

Remarks: Davis mentions that in many respects this species is very similar to *S. opacita*, which occurs in the same host.

Suborder PLATYSPOREA nom. nov.

The definition of the suborder is recorded on page 57.

Family MYXIDIIDAE Thélohan

1892	*Myxididées*	Thélohan	1892 : 173, 175
1893	*Myxidiidae*	Gurley	1893 : 412

The characters of the family are described on page 57.

Genus MYXIDIUM Bütschli

1882	*Myxidium*	Bütschli	1882 : Pl. 38

The characters of the genus are described on page 58.
Type species: *Myxidium lieberkühni* Bütschli.

MYXIDIUM LIEBERKÜHNI Bütschli

[Figs. 221 to 240]

1854		Lieberkühn	1854 : 5–6, 349
1879		Leuckart	1879 : 246
1881		Bütschli	1881 : 638–648
1882	*Myxidium lieberkühni*	Bütschli	1882 : 593–595
1883		Balbiani	1883 : 201–202, 274–275
1891	*Myxidium lieberkühni*	Pfeiffer	1891 : 20, 91, 105, 127
1894	*Myxidium lieberkühni*	Gurley	1894 : 283–289
1895	*Myxidium lieberkühni*	Thélohan	1895 : 340
1895	*Myxidium lieberkühni*	Cohn	1895 : 5–36
1898	*Myxidium lieberkühni*	Doflein	1898 : 229, 341
1902	*Myxidium lieberkühni*	Prenant	1902a : 200–217
1902	*Myxidium lieberkühni*	Laveran and Mesnil	1902 : 469–472
1906	*Myxidium lieberkühni*	Léger and Hesse	1906 : 720
1909	*Myxidium lieberkühni*	Auerbach	1909a : 71
1912	*Myxidium lieberkühni*	Schröder	1912 : 326–327
1912	*Myxidium lieberkühni*	Parisi	1912 : 286
1916	*Myxidium lieberkühni*	Mavor	1916a : 66–68
1916	*Myxidium lieberkühni*	Mavor	1916b : 373–378

Habitat: Urinary bladder of *Esox lucius* L., *Lota lota* L. (*L. vulgaris*); France, Canada (Georgian Bay), U. S. A., (Wisconsin, Lake Mendota), Italy (Lago Maggiore, Lago di Como, Milano), Germany.

Vegetative form: Form variable with lobose or immovable filiform pseudopodia. Clear differentiation of protoplasm. Cohn described third layer of protoplasm (mesoplasm). Endoplasm yellowish in older trophozoites, contains yellow globules, fat globules and hematoidin crystals. Size varying with age up to a maximum length of 300μ by a breadth of 136μ (Bütschli). Plasmotomous multiplication active. Cohn described budding of larger forms, while Laveran et Mesnil observed only the division of smaller forms. Each pansporoblast develops into two spores. Polysporous.

Spore: Elongated fusiform. Shell with longitudinal striations. Polar capsule at each end of the spore. The longer axis of polar capsules coincides with that of spore. Dimensions: length 18 to 20μ, width 5 to 6μ. Mavor's measurement: polar capsules 5μ by 2.5 to 3μ, length of polar filament 40 to 45μ.

MYXIDIUM INCURVATUM Thélohan

[Figs. 241 to 251]

1892	*Myxidium ? incurvatum*	Thélohan	1892a : 1093–1094
1895	*Myxidium incurvatum*	Thélohan	1895 : 341
1912	*Myxidium incurvatum*	Parisi	1912 : 286–287
1912	*Myxidium incurvatum*	Auerbach	1912 : 4, 39
1916	*Myxidium incurvatum*	Georgévitch	1916 : 90–91
1917	*Myxidium incurvatum*	Davis	1917 : 234–235

Habitat: Gall-bladder of *Nerophis aequoreus* L., *N. annulatus*, *N. lumbriciformis*, *Blennius pholis* L., *Callionymus lyra* L., *Fundulus majalis*, *Gambusia affinis*, *Hippocampus brevirostris*, *Mugil cephalus*, *Scorpaena scrofa* L., *Syngnathus acus* L., *S. typhle*; Roscoff, Concarneau, Marseille, Banyuls, Napoli, Bergen, Monaco, Beaufort (July).

Vegetative form: Thélohan describes as follows: Trophozoites usually small, sometimes reaching a considerable size. Pseudopodia lobose. Protoplasm pale and finely granular with refractive globules. Disporous. According to Parisi and Davis rarely monosporous. Georgévitch observed apparently the polysporous form.

Parisi's form: ectoplasm hyaline, endoplasm granular. Monosporous form 25μ long.

Davis's form: lobose pseudopodia, occasionally being drawn out into a long process. Many trophozoites often cling together closely. Diameter of rounded disporous forms about 13 to 15μ, that of monosporous forms about 10 to 11μ.

Spore: Thélohan's description is as follows: Irregular fusiform. Longest axis curved into S-form, both ends sharply pointed and directed toward opposite directions. Polar capsule opening on opposite side of the spore, in some spores the axis of the polar capsules being parallel to each other. Dimensions: length 8 to 9μ, breadth 4 to 5μ, length of polar filament 10 to 15μ.

Parisi gave the following dimensions: length 10 to 12μ, breadth 5 to 6μ, length of polar capsule 3μ, length of polar filament 28μ.

According to Georgévitch, young spores are not curved (Fig. 245).

Davis's form; Polar filaments when extruded in HCl remained tightly coiled. Dimensions: length 8 to 9μ, width 5 to 6μ, diameter of polar capsule about 3μ.

Remarks: As are shown in figures, Davis's form seems to be somewhat different from the European forms.

MYXIDIUM SPHAERICUM Thélohan
[Fig. 252]

1895	*Myxidium sphericum* (corr. *sphaericum*)	Thélohan	1895 : 341–342

Habitat: Gall-bladder of *Belone acus* (*Belone belone* L.); Banyuls, Le Vivier-sur-Mer.

Vegetative form: Trophozoites spherical or subspherical, not exceeding 20 to 22μ in diameter with lobose pseudopodia formed from the entire surface. Endoplasm granular, contains small refractive granules. Disporous.

Spore: Form similar to *M. incurvatum*, but much greater. Coiled polar filament distinctly visible in fresh spore. Dimensions: length 15 to 20μ, width 7 to 8μ, length of polar filament 60μ (KOH).

MYXIDIUM HISTOPHILUM Thélohan
[Fig. 253]

1895	*Myxidium histophilum*	Thélohan	1895 : 341

Habitat: Connective tissue of kidney and ovary of *Leuciscus phoxinus* L. (*Phoxinus laevis* Ag.); France.

Vegetative form: Small mass.

Spore: Fusiform, being compressed at the middle part. Shell with longitudinal striations. Length of the spore 15μ.

MYXIDIUM sp. Gurley
[Fig. 254]

1851		Leydig	1851 : 226, 234
1852		Leuckart	1852 : 436
1894	*Myxidium* ? sp. incert.	Gurley	1894 : 290
1899	*Myxidium* sp.	Labbé	1899 : 92

Habitat: Gall-duct of *Raja batis* L.

Vegetative form: No description.

Spore: Not described. One figure.

MYXIDIUM DANILEWSKYI Laveran
[Figs. 255 to 257]

1887		Danilewsky	1887 : 35
1897	*Myxidium danilewskyi*	Laveran	1897 : 725–726
1898	*Myxidium danilewskyi*	Laveran	1898 : 27–30

Habitat: Kidney of *Emys orbicularis* L.; France.

Vegetative form: Form elongated, circular in cross-section, tapering toward the ends. Body of greenish color, occupying the lumen of the renal tubules of the kidney. Body bent along the cavity of the tubule. Endoplasm granular, ectoplasm covering the entire surface of the body as a thin layer. Each pansporoblast develops two spores. Polysporous.

Spore: Elongated fusiform, similar to *M. lieberkühni*, but much smaller. Polar capsule at each end, extrudes filament under the action of nitric acid. Sporoplasm granular with one nucleus. Dimensions: length 12μ, breadth 3 to 4μ.

MYXIDIUM GIGANTEUM Doflein

[Fig. 258]

1898	*Myxidium giganteum*	Doflein	1898 : 285–286

Habitat: Gall-bladder of *Raja asterias*; Napoli.

Vegetative form: Rounded trophozoites. Lobose pseudopodia with slow movement, show remarkable dimensions. Posterior portion forms "Stemm-pseudopodien." Small form club-shaped. Endoplasm is of yellowish color. Diameter of large form 500μ, of medium sized 200μ, small individuals 70–90μ, quite young ones, polymorphous 8 to 40μ. Larger individual up to 700μ by 180μ. Many trophozoites form a cyst-like motionless stage, in which many individuals seem to be covered with a common gelatinous envelope. Each pansporoblast forms two spores. Polysporous.

Spore: Elongated. Fusiform in front view; in side view, one valve arch-form, the other being flat. Transparent. Two polar capsules, one at each end. Coiled polar filament is clearly seen in larger polar capsules. Dimensions: length 28μ, breadth 8μ, polar capsules 8μ by 4μ.

MYXIDIUM BARBATULAE Cépède

1906	*Myxidium barbatulae*	Cépède	1906 : 67
1906	*Myxidium barbatulae*	Cépède	1906a : 15–16

Habitat: Kidney of *Cobitis barbatula* L.; Isère.

Vegetative form: Trophozoites form cysts. Form and size vary greatly. Average size: 400 to 500μ in length and 200μ in breadth.

Spore: Irregular fusiform. Polar capsule at each end of the spore. Shell longitudinally striated, number being variable. Dimensions: length 12 to 15μ, breadth about 6μ, polar capsules 5μ by 2.5 to 3μ.

MYXIDIUM GIARDI Cépède

[Figs. 259 to 261]

1906	*Myxidium giardi*	Cépède	1906a : 16; 1906b : 170–173
1908	*Myxidium giardi*	Cépède	1908 : 93–95
1908	*Myxidium giardi*	Cépède	1908a : 8

Habitat: Kidney of *Anguilla vulgaris* Flem.; Wimereux (August).

Vegetative form: Subspherical white cysts, 800 to 900μ in diameter, surrounded by a thick (up to 30μ) membrane, composed of the connective tissue of the host.

Spore: Irregular fusiform, greatly enlarged at the middle portion. Plane of symmetry of the spore coincides with the sutural plane. Shell thick with 9 to 11 longitudinal striations on each valve, which are more clearly seen on spores stained with iron hematoxylin. Polar capsule at each end. Coiled polar filament distinct. Sporoplasm finely granular with two nuclei and refringent globules. Dimensions *in vivo*: length 9 to 10μ, width 5 to 5.6μ, thickness 4.75 to 5μ, polar capsules 3.5μ by 2μ.

MYXIDIUM PFEIFFERI Auerbach

[Figs. 262 to 265]

1908	*Myxidium pfeifferi*	Auerbach	1908 : 459–464
1910	*Myxidium pfeifferi*	Auerbach	1910c : 171–172

Habitat: Gall-bladder of *Tinca vulgaris* Cuv.; Karlsruhe.

Vegetative form: Observations in sections. More or less flattened, disc-form, often enrolled. The ectoplasm finely granular, without large pseudopodia. It is not usually distinguishable from the endoplasm which is highly alveolar and contains numerous nuclei, but no enclosures.

Spore: Form varies to some extent. Similar to *Myxidium lieberkühni*; slightly curved. Shell with fine longitudinal striations. Polar capsules two, one at each end. Polar filament is extruded by adding one drop of water to the smear of the spore, which had been dessicated for 24 hours. Sporoplasm with one or two nuclei, in one case with four small nuclei, which is thought to be an abnormal. Dimensions: length 13 to 18μ, breadth 5.2 to 5.8μ, length of polar capsule 5.2 to 6μ, length of polar filament 45 to 54μ.

MYXIDIUM INFLATUM Auerbach

[Fig. 266]

1909	*Myxidium inflatum*	Auerbach	1909 : 72–74
1909	*Myxidium inflatum*	Auerbach	1909a : 31
1910	*Myxidium inflatum*	Auerbach	1910c : 172
1912	*Myxidium inflatum*	Auerbach	1912 : 39

Habitat: Gall-bladder of *Cyclopterus lumpus* L.; Bergen (September).

Vegetative form: Extremely polymorphous. Rounded, spherical, or much elongated. Ameboid movements very active. Differentiation of protoplasm is sharp and clear, which is best observed in individuals in motion; highly hyaline ectoplasm forms very long lobose pseudopodia, into which granular endoplasm flows in slowly. Size variable. Rounded large form 44 to 45μ in diameter. Fully grown spores are set free from the mother trophozoite in comparatively short time. Spore formation similar to that of *Myxidium bergense*. Disporous and polysporous (5 spores in maximum).

Spore: Very broad compared with the length. The longitudinal axis is curved in S shape. Polar capsule situated in opposite way at each end of the spore. Dimensions: length 20.8 to 23.4μ, breadth 13 to 15.6μ, polar capsules 7.8μ, length of polar filament 90 to 100μ (KOH).

MYXIDIUM BERGENSE Auerbach

[Fig. 267]

1908		Keysselitz	1908 : 289
1909	? *Myxidium sphaericum*	Auerbach	1909 : 75–76
1910	*Myxidium bergense*	Auerbach	1910 : 61
1910	*Myxidium bergense*	Auerbach	1910c : 172
1912	*Myxidium bergense*	Auerbach	1912 : 18–39
1915	*Myxidium bergense*	Mavor	1915 : 30–31

Habitat: Gall-bladder of *Gadus virens* L., *G. aeglefinis*, *G. merlangus*, *Pleuronectes platessa* and *Sebastes viviparus*, *Melanogrammus aeglefinis*; Norway (Bergen), Canada (St. Andrew, July to September).

Vegetative form: Rounded or elongated, as the result of formation of various pseudopodia. Trophozoites partly free, partly attached to the epithelium of the bladder. Size up to 54μ in diameter. Pseudopodia of two kinds: lobose and long filose, sometimes slightly branched. Mavor observed a cyst-like stage under certain conditions, which, he thinks, may be due to some exceptional conditions of the parasite. Plasmogamy. Monosporous, disporous and polysporous.

Spore: Fusiform. Main axis curved into S shape. Form, roughly speaking, very much similar to that of *M. sphaericum* Thél. Dimensions: length 16.2 to 19μ, breadth 7 to 9μ, length of polar capsules 5.4μ, length of polar filament about three times as that of spore.

MYXIDIUM PROCERUM Auerbach

[Fig. 268]

1910	*Myxidium procerum*	Auerbach	1910 : 61–62
1910	*Myxidium procerum*	Auerbach	1910c : 172–173
1912	*Myxidium procerum*	Auerbach	1912 : 4, 39

Habitat: Gall-bladder of *Argentina silus* As.; Bergen.

Vegetative form: Not observed.

Spore: Greatly elongated and narrow. Sporoplasm with one or two nuclei. Dimensions: length 21.6 to 25.2μ, breadth 3.6 to 4μ, length of polar capsule 7.2μ.

MYXIDIUM MACKIEI Bosanquet

[Figs. 269 to 271]

1910	*Myxidium mackiei*	Bosanquet	1910 : 436–438

Habitat: Renal tubules of kidney of *Trionyx ganzeticus*; Bombay. Observations on three slides.

Vegetative form: The largest trophozoite 160μ by 27μ. No distinction between ectoplasm and endoplasm could be drawn, except in a few individuals in which there was a cyst-wall. Spores are formed in pairs. Protoplasm with two kinds of nuclei, some vesicular, others smaller and compact. Polysporous.

Spore: Fusiform with rather pointed ends. Shell finely striated. Two comparatively small polar capsules, one at each end. Sporoplasm with one or two nuclei, contains, often, two large vacuoles. Dimensions: length 16μ (a few 17μ), breadth 5μ (many broader than this).

Remarks: The discoverer, J. P. Mackie mentioned that the parasites did not appear to excite any reaction in the tissue of the host, the animal's health being unaffected.

MYXIDIUM MACROCAPSULARE Auerbach

[Figs. 272 and 273]

1910	*Myxidium macrocapsulare*	Auerbach	1910 : 440–441

Habitat: Gall-bladder of *Scardinius erythrophthalmus* L.; Karlsruhe.

Vegetative form: Not observed.

Spore: Elongated elliptical when viewed at right angles to sutural plane. Shell somewhat thick with longitudinal striations parallel to the sutural line. In side-view, both ends pointed in diagonally opposite directions. Polar capsules are comparatively large, one at each end, opening at the sharply pointed end. Dimensions: length 10 to 12μ, breadth 6μ, polar capsules 3 to 4μ.

Remarks: No pathological change. Bile was clear.

MYXIDIUM sp. Awerinzew

[Figs. 274 to 276]

1908	*Myxidium* sp.	Awerinzew	1908 : 33, 43, 45, 55
1909	*Myxidium* sp.	Awerinzew	1909 : 76, 78, 80, 81
1911	*Myxidium* sp.	Awerinzew	1911 : 199–204

Habitat: Gall-bladder of *Cottus scorpius*; Aleksandrowsk, North Sea.

Vegetative form: Trophozoites are small. The protoplasm is differentiated into ectoplasm and endoplasm in some specimens. Very active formation of filiform pseudopodia of various length. Degenerating trophozoites, with one or two empty spaces are often noticed. Each spore is formed independently from each other. Monosporous, disporous and polysporous (with three spores).

Spore: Form similar to *Myxidium incurvatum*. Young spores not curved. Dimensions: length 20 to 35μ, breadth 10 to 15μ.

MYXIDIUM DEPRESSUM Parisi

[Figs. 277 and 278]

1912	*Myxidium depressum*	Parisi	1912 : 287

Habitat: Gall-bladder of *Citharus linguatula* Gthr.; Napoli (August).

Vegetative form: Not observed.

Spore: Fusiform with greatly attenuated extremities in front view; flattened and curved in S-form in profile. The axis of polar capsules parallel to each other. Coiled polar filament visible *in vivo*. Sporoplasm with two nuclei, occupies the extracapsular cavity of the spore. Dimensions: length 12 to 14μ, breadth 5.5 to 6μ, thickness 2.5 to 3μ, polar capsules 5.5 to 6μ by 2.3μ, length of polar filament 30μ.

MYXIDIUM OVIFORME Parisi

[Figs. 279 and 280]

1912	*Myxidium oviforme*	Parisi	1912 : 287–288
1912	*Myxidium oviforme*	Auerbach	1912 : 39

Habitat: Gall-bladder of *Apogon rex mullorum* Cuv., *Coris julis* Gthr., *Gadus callarias* L., *Trutta salar* L.; Napoli (August), Norwegian coast.

Vegetative form: Unobserved by Parisi. Auerbach's observation is as follows:

Trophozoites, small ameboid, usually spherical. Size 10 to 12μ in diameter. Monosporous (probably).

Spore: Oval with rounded extremities, slightly pointed at the foramina of polar capsules. Shell with numerous fine striations running longitudinally. Polar capsules being often invisible, opening a little above and below of the hypothetical horizontal plane. Sporoplasm fills the extracapsular cavity of the spore, leaving little space at the extremities of the polar capsules. Dimensions: length 11μ, breadth 8 to 8.5μ, polar capsules 4.5μ by 3μ, length of polar filament 30 to 35μ. Auerbach's measurements: length 12 to 13μ, breadth 8 to 9μ, polar capsules about 4μ long.

MYXIDIUM ANGUILLAE Ishii

[Figs. 281 to 284]

1915	*Myxidium anguillae*	Ishii	1915 : 372–382

Habitat: Integument of the side of the body of *Anguilla japonica* Temm. et Sch.; Schizuoka, Nippon (October). Number of the cysts visible to unaided eye, 10 and 9 on the left and the right side respectively.

Vegetative form: Trophozoites form white and sharply contoured cysts. Cysts, spherical or oval, surrounded by a membranous connective tissue (about 2μ thick) of the host. Protoplasm is clearly differentiated into ectoplasm and endoplasm. Diffuse infiltration also occurs. Size measured along the skin, 1.2 to 2mm. in diameter; in sections 1.174mm. by 0.658mm.

Spore: Form similar to *Myxidium pfeifferi* Auerbach, but rather straight fusiform, rarely slightly bent. In many spores the shell tapers to a sharp point at each end. Shell striated longitudinally, 22 in all (2 sutural ridges?). Two polar capsules, one at each end. Sporoplasm usually with two nuclei. Dimensions: length 9.1μ, breadth 2.8μ, length of polar capsule 3.5μ.

MYXIDIUM sp. Mavor
[Figs. 285 and 286]

1915	*Myxidium* sp.	Mavor	1915 : 32

Habitat: Gall-bladder of *Pseudopleuronectes americanus*; New Brunswick (Canada), of rare occurrence.

Vegetative form: Observations in smears are as follows: Spheroidal, with numerous long pseudopodia on one side, which suggests the attachment of the trophozoite to the bladder. Trophozoites without any spore. Pansporoblasts spherical, 15 to 16μ in diameter.

Spore: Spindle shaped. The long axis being slighly bent in S-form. Two pear shaped polar capsules, one at each end of spore. Coiled polar filament visible in fresh state. Dimensions: length 14 to 15μ, breadth 6 to 7.5μ, polar capsules 4μ by 2.5μ, length of polar filament 90 to 95μ (ammonia water).

MYXIDIUM GADI Georgévitch
[Figs. 287 to 290]

1916	*Myxidium gadi*	Georgévitch	1916 : 88–89
1917	*Myxidium gadi*	Georgévitch	1917c : 797–799
1919	*Myxidium gadi*	Georgévitch	1919 : 251–289

Habitat: Gall-bladder of *Gadus pollachius, Solea vulgaris* Quens; Roscoff (September).

Vegetative form: Highly polymorphous. Spherical or oval. Large forms fill up the bladder. Ectoplasm hyaline and transparent, forming one long or many short lobose pseudopodia. Endoplasm colorless and finely granular, contains more or less large numbers of nucleus. Monosporous, disporous and polysporous.

Spore: Fusiform with attenuated ends. Young spores more attenuated than the fully grown forms. The main axis of the spore coincides with the longitudinal axis of the polar capsules, with slight deviation. Two nuclei of the sporoplasm, are always smaller than those of the shell-valves or of polar capsules. Dimensions: length 6 (?) to 14μ, breadth 4 to 6μ.

MYXIDIUM GLUTINOSUM Davis
[Fig. 291]

1917	*Myxidium glutinosum*	Davis	1917 : 235

Habitat: Gall-bladder of *Cynoscion regalis*; Beaufort.

Vegetative form: Elongated or irregular. Slowly ameboid, moving by means of a broad, lobose pseudopodium of hyaline ectoplasm. Body colorless. Ectoplasm only distinct in pseudopodium. Endoplasm finely granular. The mature spores while still within the mother trophozoites, are surrounded by a clear, refractive gelatinous envelope. Diameter of rounded sporulating trophozoites 20μ. Disporous.

Spore: Cylindrical, ends of valves rounded except at one side, where the polar capsules open at the apex of a small, conical elevation. Spore characterized by the presence of a transparent, homogeneous, gelatinous envelope. Polar capsules pyriform, opening on each side nearly at right angles to the longitudinal axis. Dimensions: length 10 to 11μ, breadth 6μ, length of polar capsules 3μ.

MYXIDIUM PHYLLIUM Davis

[Figs. 292 and 293]

1917 *Myxidium phyllium* Davis 1917 : 235

Habitat: Gall-bladder of *Gambusia affinis*; Beaufort.

Vegetative form: Exceptionally large; flattened, leaflike, usually folded on itself; motionless. Pseudopodia were not observed. Ectoplasm forming a distinct transparent layer around entire body. After being on slide for some time ectoplasm usually becomes covered with very numerous, short, hairlike processes. Endoplasm finely granular, contains numerous fat globules. Diameter up to 1.35mm. Polysporous.

Spore: Fusiform, slightly truncated at each end where polar capsules open. Shell with numerous longitudinal striations. Sporoplasm finely granular, with several small fat globules. Dimensions: length 11μ, breadth 8μ, diameter of polar capsules 3μ.

MYXIDIUM STRIATUM Cunha et Fonseca

1917 *Myxidium striatus* Cunha et Fonseca 1917 : 321

Habitat: Gall-bladder of *Menticirrhus americanus* L., *Bairdiella ronchus* Cuv. et Val.; Brazil.

Vegetative form: More or less spherical. Body small and colorless. Endoplasm granular. Ectoplasm visible when pseudopodia are formed. Pseudopodia filiform, being projected radially. Size variable, 16μ in diameter in average.

Spore: Elliptical. Shell with fine longitudinal striations which run parallel to sutural line. Sutural plane oblique to the longitudinal axis of the spore which is thickened at the extremities. Two ovoidal polar capsules, one at each end. Dimensions: length 10 to 14μ, breadth 6 to 8μ, length of polar capsules 4μ, length of polar filament 30μ.

MYXIDIUM KAGAYAMAI nov. spec.
[Figs. 294 and 295]

1916	*Myxidium* sp.	Kudo	1916 : 6

Habitat: Gall-bladder of *Misgurnus anguillicaudatus* Cant.; Tokio (September), 2% of the fish examined infected.

Vegetative form: Not observed.

Spore: Fusiform; one valve being more convex than the other. Suture line straight. Shell with fine longitudinal striations. Dimensions in fixed preparations: length 15 to 18μ, breadth 6 to 7μ, length of polar capsules 7 to 8μ, length of polar filament 60 to 70μ.

Remarks: Tho the vegetative form is still unobserved, the author is compelled to consider the present form as a new species by careful reexamination of the material and proposes the name in honor of Dr. T. Kagayama, Tokio, Nippon.

MYXIDIUM AMERICANUM nov. spec.
[Figs. 622 to 627]

Habitat: In the lumen of urinary tubules of the kidney of *Trionyx spinifera*; Crystal Lake, Urbana, Ill. (July). A single host specimen showed a light infection in the above mentioned organ. No intracellular stage was detected.

Vegetative form: The young trophozoite in the lumen of the tubule of the kidney is multinucleate, and more or less irregular in shape which suggests the ameboid movements of the animal (Figs. 622, 623). The older form with mature spores is rather spherical in form with a distinct outline. The protoplasm is fairly well differentiated into ectoplasm and endoplasm (Fig. 624). The size of the trophozoites varies from 12 to 25μ in diameter. A pansporoblast produces two spores. Polysporous.

Spore: Spindle-form; with the two pointed extremities stretched in opposite directions. Circular in cross-section. The shell is rather thin; sutural line is straight. Fine longitudinal striations on the shell, eight to ten in number on each valve. The polar capsules are nearly spherical, coiled polar filament being visible in fresh material (three turns). The polar filament is easily extruded from the fresh spores under the influence of potassium hydrate solution. The direction of the extruded polar filament forms an angle of about 45° with the main axis of the spore and the two filaments are parallel to each other. Preserved spores do not show any filament extrusion under the influence of the said chemical. The sporoplasm is finely granular, and shows, upon staining, two small nuclei of ring-shape, as their peripheral layer takes stain more deeply than the central portion. Average dimensions of fresh spores: length 15 to 16μ, breadth 5.5 to 6μ, polar capsule 4μ by 3.5μ, length of polar filament 25 to 32μ.

Remarks: Two species of the genus Myxidium were reported to occur in chelonian hosts; i.e., *M. danilewskyi* (page 109) and *M. mackiei* (page 112). The former differs from the present form in having an elongated vegetative form which is greenish in color, and in having spores of different shape, dimensions and structure, not to speak of the difference of the host. The latter resembles closely to the species under consideration in dimensions of the spores, but differences in the trophozoite and in the structure of the spore do not allow one to consider two forms as identical. The species is therefore treated as new.

Genus SPHAEROMYXA Thélohan

1892	*Sphaeromyxa*	Thélohan	1892a : 1091–1093

The characters of the genus are described on page 58.

Type species: *Sphaeromyxa balbianii* Thélohan.

SPHAEROMYXA BALBIANII Thélohan

[Figs. 296 to 307]

1892	*Sphaeromyxa balbianii*	Thélohan	1892a : 1091–1093
1895	*Sphaeromyxa balbianii*	Thélohan	1895 : 342
1912	*Sphaeromyxa balbianii*	Parisi	1912 : 288
1916	*Sphaeromyxa balbianii*	Georgévitch	1916 : 92–93
1917	*Sphaeromyxa balbianii*	Davis	1917 : 235–236

Habitat: Gall-bladder of *Motella tricirrata* Bl., *M. maculata* Risso., *Cepola rubescens* L., *Clupea pilchardus*, *Siphostoma floridae*, *S. louisianae*; Roscoff (September), Concarneau, Marseille, Banyuls, Napoli (September), Beaufort (June to August).

Vegetative form: Flattened leaf-like or disc-form, reaching 3 to 4mm. in diameter. Often forms spherical with opaque appearance. The protoplasm is distinctly differentiated into endoplasm and ectoplasm. Ectoplasm forms rounded lobes which exhibit slow movements and show a clear radially striated structure in sections. Endoplasm reticular, contains nuclei, young and mature spores and fat globules. Each pansporoblast develops two spores. Polysporous.

Davis mentions that the largest form he observed was 900μ in diameter.

Georgévitch recognized a large number of small trophozoites which were formed by repeated plasmotomous multiplication.

Spore: Fusiform, with truncate ends. Shell longitudinally striated. One polar capsule at each end. Polar filament is wound around an imaginary axis perpendicular to the longitudinal axis of the spore. When extruded, the polar filament is seen as a short, conical and hollow thread-like structure. Sporoplasm finely granular with two nuclei. Dimensions: length 15μ, width 5μ, length of polar filament 15μ.

Parisi gave the following dimensions: length 15 to 20μ, width 5 to 6μ, polar capsule 7μ by 4.7μ, length of polar filament 25 to 30μ.

Davis' measurements are as follows: length 17 to 20μ, breadth 5 to 6μ, length of polar filament 20μ.

Georgévitch observed young spores with both ends tapering into a point. Later they assume the typical form with truncated ends. He did not recognize the striations on the shell. He also mentions the occurrence of abnormal spores, such as elliptical, spherical forms, etc.; or with only one polar capsule.

SPHAEROMYXA IMMERSA (Lutz) Thélohan

[Figs. 308 to 311]

1889	*Cystodiscus immersus*	Lutz	1889 : 84–88
1895	*Sphaeromyxa immersa*	Thélohan	1895 : 343
1899	*Cystodiscus immersus*	Lühe	1899 : 291–293

Habitat: Gall-bladder of *Bufo marinus* L. and *Leptodactylus ocellatus* L.; Brazil.

Vegetative form: Leaf-like or disc form, visible thru the bladder wall. Upper and lower sides slightly convex. Size up to 1.5 or 2mm. in diameter; thickness being 1/20 to 1/10 of the diameter. Protoplasm is well differentiated. Ectoplasm transparent and membranous, often contains a large number of micrococcus-like bodies. No ameboid movements nor change of form. Endoplasm highly vacuolar, contains fat globules. Plasmotomic multiplication probably occurs. Spores always arranged in pairs. Polysporous.

Spore: Oval with rounded extremities. Shell more or less thick, with fine transverse striations. Spherical polar capsule at each end. Sutural plane is oblique to the longitudinal axis of the spore. Sporoplasm transparent. Dimensions: length 12 to 14μ, breadth 9 to 10μ, length of polar filament 50 to 70μ (4 to 5 times that of the spore) (KOH).

SPHAEROMYXA INCURVATA Doflein

[Figs. 312 to 314]

1898	*Sphaeromyxa incurvata*	Doflein	1898 : 286–287

Habitat: Gall-bladder of *Blennius ocellatus*; Napoli.

Vegetative form: Trophozoites are found in large masses (Plasmodia ?), in which they form a thin, hollow ball, 5–7mm. in diameter.

As the surface is greater than the inner surface of the bladder, some parts of the body are folded up. Body bluish white and transparent. Protoplasm highly vacuolar, contains numerous fat globules, nuclei and spores. Polysporous.

Spore: Curved to one side along sutural plane and also in a plane at right angles to it. Polar capsule at each end. Sporoplasm with two nuclei.

Polar filament is wound along the longer diameter of the capsule, and relatively thick, but thinner than that of *S. balbianii* Thél. Dimensions: length (along the inner side of the arch) 30 to 35μ, breadth 8μ, distance between two polar capsules 12 to 15μ, polar capsules 12 to 15μ by 4 to 5μ.

SPHAEROMYXA SABRAZESI Laveran et Mesnil

[Figs. 315 and 322]

1900	*Sphaeromyxa sabrazesi*	Laveran et Mesnil	1900 : 380–382
1906	*Sphaeromyxa sabrazesi*	Schröder	1906 : 455–466
1907	*Sphaeromyxa labrazesi**	Schröder	1907 : 359–381
1910	*Sphaeromyxa sabrazesi*	Schröder	1910 : 1–5
1912	*Sphaeromyxa sabrazesi*	Parisi	1912 : 288
1913	*Sphaeromyxa sabrazesi*	Jameson	1913 : 2
1916	*Sphaeromyxa sabrazesi*	Georgévitch	1916 : 91–92
1916	*Sphaeromyxa sabrazesi*	Georgévitch	1916a : 3

Habitat: Gall-bladder of *Hippocampus brevirostris* Cuv., *H. guttulatus* Cuv.; *Syngnathus acus*, *Motella tricirrata*, *Nerophis annulatus*, *Siphonostoma rondeletii*; Arcachon, Rovigno, Napoli, Roscoff (September), Monaco, Villefrance, (March to June).

Vegetative form: Disc form. Diameter up to 2mm. Thickness variable. Body whitish in color. Ectoplasm thin, transparent and homogeneous. Young trophozoites may probably have lobose pseudopodia. Endoplasm highly vacuolated, contains nuclei of various sizes, pansporoblasts, spores and more or less refringent granules. Polysporous.

Schröder observed larger forms up to 5mm. Ectoplasm also was found to project numerous fine short (1μ) hair-like processes from the surface. Each pansporoblast develops into two spores.

Spore: Cylindrical, bent in arch form; with truncated ends. Large cylindrical polar capsule at each end. Sporoplasm granular, contains one nucleus. Polar filament short and conical, is extruded under the action of nitric acid. Dimensions: length 28μ, width 4.3μ, polar capsule 9 to 10μ by 3μ, distance between the polar capsules 8μ, length of polar filament 8μ.

Schröder noticed the stained sporoplasm contained one or two nuclei. He observed indistinctly marked longitudinal striations on the shell. Dimensions: length 22 to 25μ, breadth 3 to 4μ, polar capsule 8μ by 2 to 3μ, length of polar filament about 12μ.

Georgévitch described the presence of a hyaline substance, containing pale granules, in the spore cavity. Young spores were found to take the form of Myxidium type. In mature spores, he always found two nuclei by staining.

*Misprinted in Schröder's paper.

SPHAEROMYXA HELLANDI Auerbach
[Figs. 323 and 324]

1909	*Sphaeromyxa hellandi*	Auerbach	1909 : 78–79
1910	*Sphaeromyxa hellandi*	Auerbach	1910b : 772–774
1910	*Sphaeromyxa hellandi*	Auerbach	1910c : 174–175
1912	*Sphaeromyxa hellandi*	Auerbach	1912 : 4, 40

Habitat: Gall-bladder of *Molva vulgaris* Flem., *Centronotus gunellus*, *Brosmius brosme* Asc.; Bergen, Torghatten.

Vegetative form: Large and rounded disc form. Protoplasm is distinctly differentiated into ectoplasm and endoplasm. Thickness up to 160μ, folded in the bladder. Ectoplasm finely granular; in unstained specimens, it is recognizable as 10 to 12μ thick layer, in which about 2μ thick radially striated outer layer and 8 to 10μ thick inner finely granular region can be distinguished. In stained sections, the outer layer remains unstained. Endoplasm highly alveolar, contains refractive granules of different size which are not stained with Sudan III. Each pansporoblast develops into two spores. Polysporous.

Spore: Arch form in front view. The degree of curvature varies greatly. Sutural line curved in S-shape and well marked. Both ends more or less truncated. Polar capsule at each end. Polar filament being wound along the longest axis of the polar capsule and is extruded with KOH. Sporoplasm rounded with one or two nuclei. Dimensions: length 20.8 to 26μ, breadth and thickness 5.4μ, length of polar capsule 10 to 10.8μ.

SPHAEROMYXA EXNERI Awerinzew
[Figs. 325 and 326]

1913	*Sphaeromyxa exneri*	Awerinzew	1913a : 155

Habitat: Gall-bladder of *Thysanophris japonicus*; Lorenço Marques (Africa).

Vegetative form: Not observed.

Spore: Somewhat resembles that of *S. hellandi* Auer. in being bent to one side with sutural line of S-form but differs in dimensions. Both ends slightly tapering. Polar capsules two, one at each blunt end, in which the polar filament is wound parallel to its longer axis. Sporoplasm comparatively small and sharp-contoured, contains only one nucleus. Dimensions: length 75 to 80μ, breadth 18 to 20μ, length of polar capsule 30 to 35μ.

SPHAEROMYXA GASTEROSTEI Georgévitch
[Fig. 327]

1916	*Sphaeromyxa gasterostei*	Georgévitch	1916 : 88

Habitat: Gall-bladder of *Gasterosteus spinachia*; Roscoff (September).

Vegetative form: Trophozoites form large plasmodia.

Spore: Large, elongated fusiform; ends less truncated than those of the spore of *Sphaeromyxa balbianii*. As the spore becomes mature, the ends assume more pointed shapes. Polar capsules two, one at each end. Sporoplasm with two nuclei, fills the extracapsular cavity. Dimensions: twice or three times larger than those of *Sphaeromyxa balbianii* Thélohan.

Genus ZSCHOKKELLA Auerbach

1910	*Zschokkella*	Auerbach	1910 : 62–63
			1910a : 240–256
			1910c : 175

The characters of the genus are described on page 58.

Type species: *Zschokkella hildae* Auerbach.

ZSCHOKKELLA HILDAE Auerbach
[Figs. 328 to 331]

1910	*Zschokkella hildae*	Auerbach	1910 : 62–63
1910	*Zschokkella hildae*	Auerbach	1910a : 240–254
1912	*Zschokkella hildae*	Auerbach	1912 : 40–41

Habitat: Urinary bladder of *Phycis blennioides* Br., *Gadus aeglefinis*, *G. callarias* L., *G. virens* L.; Norway.

Vegetative form: Trophozoites float in the bile or attach themselves to the epithelial layer of the bladder. Youngest ameboid form about 4.5 to 6μ. In floating form, pseudopodia more or less long, lobose, are formed; while in the attached form those similar to the pseudopodia of *Myxidium bergense* Auer. are developed. Plasmogamy occurs. Size varies greatly according to the number of spores which are formed in each individual. Monosporous (with or without the remnant of protoplasm), disporous and polysporous (up to 4 spores).

Spore: Semicircular in front view, with slightly and equally attenuated ends. At each end, large spherical polar capsule is situated which opens not at the extremity, but on the flat surface. Shell bivalve and thick. Sutural line S-form. Sporoplasm with two nuclei. Dimensions: length 16 to 28.8μ, breadth 13 to 18μ, polar capsules 5.6 to 7.2μ in diameter, length of polar filament 72μ (KOH).

ZSCHOKKELLA NOVA Klokačewa
[Figs. 332 and 333]

1914	*Zschokkella nova*	Klokacewa	1914 : 184–186

Habitat: Gall-bladder of *Carassius vulgaris*; Russia?

Vegetative form: Not observed.

Spore: Outline irregular. Observations on fixed materials alone. Two large round polar capsules open at the side near ends. Sporoplasm with two nuclei. On some spores, striations that run parallel to the sutural line were observed. Dimensions: length 9.5 to 11.5μ, breadth 6.5 to 7μ, diameter of polar capsule 3 to 3.5μ.

ZSCHOKKELLA ACHEILOGNATHI Kudo
[Figs. 334 to 338]

1916 *Zschokkella acheilognathi* Kudo 1916 : 3–5

Habitat: Gall-bladder and gall-duct of *Acheilognathus lanceolatum* Temm. et Schl.; Tokio (May). Over 80% of the fish examined were found to be infected.

Vegetative form: Disc-shape. In bile duct, large trophozoites are folded up. Body colorless and transparent. Protoplasm is well defined into two regions. Ectoplasm finely granular *in vivo*. In stained sections, it shows two layers; thin outer layer (2μ thick) presents very fine striations, while inner layer (6 to 8μ thick) is finely vacuolated without any enclosure. Endoplasm is highly vacuolated. Lobose pseudopodia formed only in younger individuals (15 to 30μ in diameter), in which ameboid movements are not slow. Size: up to 720μ by 550μ, thickness 5 to 30μ. Polysporous.

Spore: Form resembles *Zschokkella hildae*, but slightly elongated. Form varies to some extent. Some spores are of Myxidium type. Sutural line curved. Longitudinally striated. Spherical polar capsule at each end opening near the extremity. Dimensions: length 10 to 14μ, breadth 6 to 7μ, diameter of polar capsule 3 to 5μ, length of polar filament 65 to 70μ (KOH).

ZSCHOKKELLA GLOBULOSA Davis
[Figs. 339 and 340]

1917 *Zschokkella globulosa* Davis 1917 : 236

Habitat: Urinary bladder of *Spheroides maculatus*; Beaufort (August).

Vegetative form: Rounded; slowly ameboid, forming short, lobose pseudopodia. Body colorless and transparent. Ectoplasm not distinct. Protoplasm granular, characterized by the presence of several large fat globules. Sporulating trophozoites about 15 to 16μ in diameter. Monosporous and disporous.

Spore: Semicircular. Sutural line twisted on its axis and oblique to longitudinal axis; sutural ridge distinct. Polar capsules opening on flat surface. Sporoplasm finely granular and very transparent. Dimensions: length 11μ, breadth 7μ, diameter of polar capsules 3μ.

Family MYXOSOMATIDAE Poche

1913 *Myxosomatidae* Poche 1913 : 230

The characters of the family are described on page 58.

Genus MYXOSOMA Thélohan

1892 *Myxosoma* Thélohan 1892 : 175

The characters of the genus are described on page 58.

Type species: *Myxosoma dujardini* Thélohan.

MYXOSOMA DUJARDINI Thélohan

[Figs. 341 to 343]

1841		Müller	1841 :486–487
1845		Dujardin	1845 : 644
1892	*Myxosoma dujardini*	Thélohan	1892 : 175
1895	*Myxosoma dujardini*	Thélohan	1895 : 343–344
1905	*Myxosoma dujardini*	Nufer	1905 : 77, 79, 186
1910	*Myxosoma dujardini*	Wegener	1910 : 72–73
1916	*?Myxosoma dujardini*	Kudo	1916 : 3

Habitat: Branchial lamellae of *Scardinius erythrophthalmus* L., *Perca fluviatilis*, *Leuciscus rutilus* L. and *Cyprinus carpio* L.; France, Frisches Haff, Kurisches Haff (February, April, May), Tokio (May), Switzerland.

Vegetative form: White cysts being branched, rounded, spherical or irregular; 1 to 1.5mm. in diameter.

Wegener's form 1 to 1.7mm. long.

Spore: Ovoidal, flattened, with attenuated anterior end which is slightly bent laterally. Two pyriform polar capsules at the anterior end. Sporoplasm without any iodinophilous vacuole. Dimensions: length 12 to 13μ, breadth 7 to 8μ.

Wegener's form: polar capsules 6μ by 3μ.

Kudo's form: polar capsules 6 to 7μ by 2μ, length of polar filament 70μ.

MYXOSOMA (?) LOBATUM Nemeczek

[Fig. 348]

1911	*Myxosoma* (?) *lobatum*	Nemeczek	1911 : 160–162

Habitat: Branchiae of *Leuciscus leuciscus* L. and *Aspius rapax* Ag.; Austria.

Vegetative form: Cysts spherical, oval or elongated; of white color. Size from 0.5 to 3mm. by 0.5 to 1mm. Those in *Aspius rapax*, oval to spindle-shape, 1 to 3mm. long and 1 to 1.5mm. wide.

Spore: Ovoidal; anterior end narrowly pointed and straight; posterior end rounded, with lobose appendix (about 6μ long). A transverse fold on the shell behind the polar capsules in fresh as well as preserved spores. No iodinophilous vacuole. Dimensions: length 12.6μ, breadth 8.2μ, length of polar capsule 4.2μ, length of polar filament 80 to 90μ. Spores found in *Aspius rapax*, had slight difference in dimensions, the structure, however, being similar to the above.

Remarks: Nemeczek doubts if this form is really Myxosoma because of the following: 1) different shape of the cysts compared with that of the type species as described by Thélohan; 2) spores observed might develop later into other forms like Henneguya.

MYXOSOMA FUNDULI Kudo
[Figs. 344 to 347]

1918	*Myxosoma funduli*	Kudo	1918 : 12–14

Habitat: Branchiae of *Fundulus majalis* Wal. and *F. heteroclitus* L; Woods Hole (August, September).

Vegetative form: Cysts. Spherical and small; 150μ in average diameter. Largest form observed 360μ by 264μ. Spores, young and mature, were found in the cysts. Polysporous.

Spore: Pyriform. Shell uniformly thick with 7 to 10 folds on sutural edge at the posterior portion. Sutural ridge, fairly well marked. Two polar capsules pyriform and of equal size at the anterior end. Sporoplasm finely granular with two nuclei but without any iodinophilous vacuole. Dimensions: length 14μ, breadth 8μ, thickness 6μ, polar capsule 8μ by 2μ, length of polar filament 38 to 42μ (perhydrol, KOH).

Remarks: The writer could not find any evidence of an iodinophilous vacuole by treatment with various iodine mixtures, which is the most important characteristic of the genus. Hahn's form (*Myxobolus funduli*, p. 151) should be distinguished from the present form.

Genus LENTOSPORA Plehn

1905	*Lentospora*	Plehn	1905 : 150

The characters of the genus are described on page 58.

Type species: *Lentospora cerebralis* (Hofer) Plehn.

LENTOSPORA CEREBRALIS (Hofer) Plehn
[Figs. 349 to 354]

1903	*Myxobolus cerebralis*	Hofer	1903 : 8
1904	*Myxobolus chondrophagus*	Hofer	1904 : 53
1905	*Lentospora cerebralis*	Plehn	1905 : 145–166
1909	*Lentospora cerebralis*	Plehn	1909 : 38
1910	*Lentospora cerebralis*	Auerbach	1910c : 176

Habitat: Cartilage and perichondrium of *Trutta iridea* Gibb., *Salmo fontinalis* Mitch., *Trutta salar* L.; Germany (Karlsruhe and other localities).

Vegetative form: Ameboid form. Size varies greatly. Small ameboid form probably grows up into large individual which has often fifty or more ringform nuclei and breaks up into numerous small forms by division. No sporous character is observed except a figure of a disporous form.

Spore: Circular in front view; lenticular in side view, with more or less extensive variation in length and breadth. Shell smooth. Sutural ridge distinctly thickened. Two polar capsules pyriform and convergent, are usually of same size. Extruded polar filaments cross each other. Sporoplasm with two ring-form nuclei but without any iodinophilous vacuole.

Dimensions: diameter 6 to 10μ, length of polar capsule 2/5 that of the spore, length of polar filament 40 to 50μ (limewater, 1% KOH).

Remarks: Plehn noticed that the present form causes the chronic form of "Drehkrankheit" among young fish in German waters. She was unable to extrude the polar filament with mineral (?) acids. Auerbach, however, could extrude the filament by means of acids.

LENTOSPORA MULTIPLICATA Reuss

[Fig. 355]

1906	*Lentospora multiplicata*	Reuss	1906 : 203

Habitat: Muscle of *Idus melanotus* Heck.; Volga?, Russia.

Vegetative form: Not described.

Spore: Oval. Sutural edge broad with many folds. No iodinophilous vacuole. Dimensions: length 12μ, breadth 9.5μ, thickness 6μ, polar capsules 4μ by 2.25μ.

LENTOSPORA ENCEPHALINA Mulsow

1911	*Lentospora encephalina*	Mulsow	1911 : 483–485

Habitat: In the blood vessel of the brain, especially of the mid-brain of *Cyprinus carpio* L.; Munich (spring). Blood vessels are the only seat of infection. In most cases many individuals lie parallel to one another. The infection occurs frequently and heavily. The effect, however, is undetermined.

Vegetative form: Trophozoite elongated, worm-like and circular in cross section. The body is covered with a pellicula. The protoplasm is distinctly differentiated into homogeneous ectoplasm layer and inner endoplasm. In the latter are found numerous granules, small nuclei and spores.

Spore: Almost circular in front view; profile? No iodinophilous vacuole is found. The polar filament is easily extruded by means of a highly diluted KOH solution. Diameter: 5 to 5.5μ.

LENTOSPORA ASYMMETRICA Parisi

[Figs. 356 to 359]

1912	*Lentospora asymmetrica*	Parisi	1912 : 292–293

Habitat: Connective tissue of kidney of *Crenilabrus pavo* C. *et* V.; Napoli (September).

Vegetative form: One trophozoite found; a small, rounded form with thin and hyaline ectoplasm which could be distinguished from the endoplasm with coarse yellowish globules, containing two spores. Disporous?

Spore: Oval from the front; flattened and fusiform in profile. Sutural edge with many triangular folds, which are more clearly seen in material preserved in formalin than in fresh condition. Two polar capsules of same size, are situated asymmetrically, opening at the side near the anterior end. Sporoplasm granular and with two nuclei, but without any iodinophilous vacuole. The polar filament not being extruded by ordinary reagents, probably because the spores were not full-grown. Dimensions: length 10 to 11μ, breadth 6.5 to 7μ, length of polar capsules 5μ.

LENTOSPORA ACUTA (Fujita) Kudo

[Figs. 360 to 362]

1912	*Sphaerospora acuta*	Fujita	1912 : 260–261

Habitat: Epithelium of branchial lamellae of *Carassius auratus* L.; Sapporo, Nippon.

Vegetative form: Fujita's description is simply as follows: Sporoblast contains about two spores.

Spore: Spherical in front view, with slightly pointed anterior end; spindle shaped in side-views. Shell thin and smooth. Two convergent polar capsules are of different sizes, occupying about 5/8 in space of the spore. No vacuole could be made out in sporoplasm. Dimensions: length 8 to 10μ, breadth 7 to 8μ, thickness 5 to 6μ, polar capsules 5μ by 4μ.

Remarks: This species, recorded incompletely by Fujita as Sphaerospora, shows characters of the genus *Lentospora* in spore form so that it is provisionally placed here.

LENTOSPORA DERMATOBIA Ishii

[Figs. 594 to 596]

1916	*Lentospora dermatobia*	Ishii	1916 : 472–474

Habitat: In the integument of *Anguilla japonica* Temm. et Schl.; Shizuoka, Nippon. From the same specimen which harboured *Myxidium anguillae*, see page 114. The number of cysts reaches probably "several hundreds."

Vegetative form: Cysts, beneath the epidermis, usually subcircular, more or less irregularly triangular or quadrilateral under the magnifier, with the largest diameter of from 142 to 267μ. The epidermis is slightly lifted up by the cyst. No chromatophore on the surface of the cyst. The cysts separated from each other, are found mostly in the central region of the body, head and fins being free from cysts. In cross-section, cysts exhibit oval or lenticular shape with the longest diameter, which is twice as long as the depth, placed parallel to the surface of the skin. No particular pathological change was noticed.

Spore: Circular in front view; broad fusiform or lenticular in side view. Sutural ridge fairly distinct. Sutural edge comparatively broad, especially at the posterior margin, where a few folds (three are figured) are seen. Two oval polar capsules convergent and of equal size. Sporoplasm is sharply contoured, no iodinophilous vacuole being recognized. Dimensions in preserved material (?): diameter 6.3 to 7μ, thickness 4.2 to 4.9μ, length of polar capsule 2.8 to 3.5μ.

Family MYXOBOLIDAE Thélohan

1892	*Myxobolidées*	Thélohan	1892 : 173, 176
1893	*Myxobolidae*	Gurley	1893 : 412, 413
1895	*Myxobolidées*	Thélohan	1895 : 347

The characters of the family are described on page 58.

Genus MYXOBOLUS Bütschli

1882	*Myxobolus*	Bütschli	1882 : Pl. 38 : 6–10

The characters of the genus are described on page 58.
Type species: *Myxobolus mülleri* Bütschli.

MYXOBOLUS MÜLLERI Bütschli
[Figs. 397 to 403]

1881		Bütschli	1881 : 630
1882	*Myxobolus mülleri*	Bütschli	1882 : 595
1895	*Myxobolus mülleri*	Thélohan	1895 : 349
1905	*Myxobolus mülleri*	Nufer	1905': 77, 79, 186
1906	*Myxobolus mülleri*	Cépède	1906 : 64–65
1906	*Myxobolus mülleri*	Schröder	1906 : 195
1908	*Myxobolus mülleri*	Auerbach	1908 : 456
1909	*Myxobolus mülleri*	Auerbach	1909a : 54, 71
1910	*Myxobolus mülleri*	Wegener	1910 : 81
1911	*Myxobolus mülleri*	Nemeczek	1911 : 160
1912	*Myxobolus mülleri*	Parisi	1912 : 293

Habitat: Air bladder and branchiae of *Leuciscus cephalus* L.; kidney and ovary of *L. phoxinus* L.; eye of *Crenilabrus melops* L. and *Alburnus lucidus;* branchiae of *Aspro asper* L., *Barbus vulgaris* Flem., *Leuciscus rutilus* L., *Squalius cephalus* L., *S. agassizii* Heckel, *Lota vulgaris* L., *Phoxinus loevis* Ag.; pseudobranchiae of *Cottus gobio* L.; intestine of *Mugil auratus* Risso.; France, Germany [Karlsruhe, Alle (October), Pregel, Frisches Haff], Switzerland (Neuchatel Lake), Italy (Napoli, September).

Vegetative form: White cysts in the connective tissue. Form elongated oval, 2 to 3mm. in diameter. No clear differentiation of protoplasm is observed even in young forms. In sections, some cysts show radiate striations in the thick granule-free ectoplasm. Endoplasm filled with nuclei.

Cépède writes as follows: Cysts in branchiae, subspherical or elliptical, 1.5mm. by 0.5mm.

Wegener's form: Cysts small and rounded, 0.2 to 0.3mm. in diameter.

Spore: Ordinarily spherical or subspherical. Two polar capsules with a small triangular intercapsular appendix. Polar capsules pyriform and of same size. Sutural edge exhibits folds (7 to 9).

Thélohan's dimensions: length 10 to 12μ, breadth 9 to 11μ, length of polar capsule 5μ.

Cépède gave the following dimensions in vivo: length 10μ, breadth 9μ, thickness 6μ, length of polar capsule 5μ.

Wegener's form. Usually oval, often almost spherical. Length 10 to 11μ, breadth 8 to 9μ, diameter of spherical form 9μ, polar capsule 4 to 5μ by 2 to 3μ.

MYXOBOLUS PIRIFORMIS Thélohan
[Figs. 363 to 364]

1852		Remak	1852 : 144
1883		Balbiani	1883 : 197–198
1884		Balbiani	1884 : 125
1891		Pfeiffer	1891 : 132
1892	*Myxobolus piriformis*	Thélohan	1892 : 177
1893	*Myxobolus piriformis*	Gurley	1893 : 414
1894	*Myxobolus piriformis*	Gurley	1894 : 211
1895	*Myxobolus piriformis*	Thélohan	1895 : 348
1905	*Myxobolus piriformis*	Nufer	1905 : 77, 186
1910	*Myxobolus piriformis*	Plehn	1910 : 22–27
1910	*Myxobolus piriformis*	Wegener	1910 : 73

Habitat: Branchiae, spleen, kidney of *Tinca tinca* L., *Cobitis fossilis* L. and subcutaneous connective tissue, spleen, liver, connective tissue of the intestine of *Leuciscus* sp.; France, Germany (Pregel), Switzerland.

Vegetative form: Small, long thread-like cysts. Color white. Polysporous.

Wegener's form: average size, length 1mm., breadth 0.09 to 0.1mm

Spore: Elongated oval; flattened. Anterior end highly attenuated and slightly bent to one side. One pyriform polar capsule at this end. Dimensions: length 16 to 18μ, breadth 7 to 8μ, length of polar filament 30μ.

Wegener gives the following dimensions: length 18μ, breadth 7.5μ, polar capsule 7.5μ by 3.5μ.

MYXOBOLUS UNICAPSULATUS Gurley
[Figs. 365 to 366]

1841		Müller	1841 : 487
1893	*Myxobolus unicapsulatus*	Gurley	1893 : 414
1894	*Myxobolus unicapsulatus*	Gurley	1894 : 210–211

Habitat: In the skin of *Labeo niloticus* For.; Nile.

Vegetative form: Cysts very small pustules in the skin of the head.

Spore: Form similar to *Myxosoma dujardini*. A single polar capsule at the anterior end, obliquely directed. Dimensions: length 0.0051‴, breadth 0.0034‴.

MYXOBOLUS FUHRMANNI Auerbach
[Fig. 367]

1909	*Myxobolus fuhrmanni*	Auerbach	1909 : 65–68
1910	*Myxobolus fuhrmanni*	Auerbach	1910c : 178–179

Habitat: Connective tissue under the mucous membrane of the mouth of *Leuciscus rutilus* L.; Neuchatel Lake.

Vegetative form: Cysts, of pea-size, surrounded by several membranous layers of connective tissue with a few nuclei. Finely granular ectoplasm forms outer layer. Endoplasm is dense and contains faintly stained nuclei. Pansporoblasts and spores are found in the central portion of the cyst. Polysporous.

Spore: Elongated pyriform, with attenuated anterior and rounded posterior ends. Majority with a single polar capsule; spores with two polar capsules were also observed. Shell thick, at the posterior end. 4 to 6 notch-like markings on the posterior part of the shell. Sutural ridge thickened and fairly well marked. Coiled polar filament visible in preserved material. The opening of the polar capsule is either at the anterior end or near it. Sporoplasm with two nuclei of unequal size and a comparatively large iodinophilous vacuole, stained brown with iodine alcohol. Dimensions: length 18 to 20μ, breadth about 8μ, thickness 6μ, length of polar capsule 9 to 10μ.

MYXOBOLUS OCULI-LEUCISCI Trojan
[Fig. 368]

1909	*Myxobolus oculi-leucisci*	Trojan	1909 : 679–682

Habitat: Vitreous body of the eye of *Leuciscus rutilus* L.; Prague (May?).

Vegetative form: Two cysts, spherical and subspherical, 100 to 180μ in diameter. Ectoplasm finely granular. Outer portion of endoplasm with small nuclei, then larger nuclei each surrounded by protoplasm, while the central portion contains spores. Polysporous.

Spore: Elongated oval, flattened dorso-ventrally. Posterior margin rounded. At the anterior end, a single polar capsule with distinctly visible coiled polar filament. Shell smooth without any markings. Sporoplasm with one nucleus, usually elongated oval (2.8μ in diameter) and one vacuole, occupies more than half of the space of the spore. Dimensions: length 9 to 10μ, breadth 4.5 to 5.5μ, thickness 3μ, polar capsule 5μ by 2μ.

MYXOBOLUS TOYAMAI Kudo

[Figs. 369 to 370]

1915	*Myxobolus toyamai*	Kudo	1915 : 517–523
1917	*Myxobolus toyamai*	Kudo	1917 : 163–170

Habitat:—Connective tissue of branchial lamellae of *Cyprinus carpio* L.; Tokio (July).

Vegetative form: Cysts, ovoidal or in shape of calabash. Small form 67 by 50μ, shows clear differentiation of protoplasm. Ectoplasm radially striated, often, differentiates fine processes (2 to 3μ long). Endoplasm coarsely granular, contains nuclei from 1 to 4μ in diameter. Size up to 190μ in greatest diameter in sections. Two spores are formed in each pansporoblast. Polysporous.

Spore: Pyriform, with attenuated anterior and rounded posterior ends. No bilateral symmetry. Lateral sides are curved. Calabash shaped spores often occur. Shell without any marking, thickened at the anterior end. Sutural ridge shows sometimes a short (1.5μ long) tail-like process at the posterior tip. A single pyriform polar capsule at the anterior end; in stained preparations, a small, oblong mass of protoplasm is seen between the polar capsule and the shell. Coiled polar filament distinct. Sporoplasm with two nuclei of usually same size and a relatively large iodinophilous vacuole, 3μ in diameter. Dimensions: length 15μ, breadth 7 to 8μ, thickness 5 to 6μ, polar capsule 7 to 8μ by 3 to 4μ, length of polar filament 40 to 45μ (pressure, perhydrol, KOH).

MYXOBOLUS NOTATUS Mavor

[Figs. 371 to 372]

1916	*Myxobolus notatus*	Mavor	1916a : 70–71

Habitat: Connective tissue of the voluntary muscles on the sides or tail of *Pimephales notatus* Raf.; Georgian Bay, Canada (Summer).

Vegetative form: Cysts as large as 3mm. in diameter, are surrounded by a layer of columnar epithelial cells (origin and significance?) and a dense layer of connective tissue. Protoplasm is not clearly differentiated, tho the cyst is surrounded by an area devoid of nuclei. In the outer region of endoplasm, numerous nuclei each with a caryosome, are recognized. In the course of spore formation, two nuclei for polar capsules appear at first, one of which degenerates later. Polysporous.

Spore: Pyriform, with a posterior extension forming a process, 5μ in length and as broad as the spore. A single polar capsule at the anterior end. An iodinophilous vacuole in the sporoplasm. Dimensions: length 17 to 18μ, breadth 7.5 to 8μ, polar capsule 7μ by 4μ, length of polar filament 95μ.

MYXOBOLUS sp. Kudo

1918	*Myxobolus* sp.	Kudo	1918 : 15

Habitat: Spleen of *Perca flavescens*; West Falmouth, Mass. (August). Isolated spores were noticed in one fish, in smears and section preparations.

Vegetative form: Not observed.

Spore: Ovoidal, attenuated at the anterior end. Shell uniformly thick. A single polar capsule opens at the anterior tip. Sporoplasm contains an iodinophilous vacuole and two nuclei of equal size (2μ). Dimensions: length 18 to 20μ, breadth 8μ, polar capsule 7 to 9μ by 3 to 6μ.

MYXOBOLUS ROHITAE Southwell et Prashad

[Figs. 373 to 374]

1918	*Myxobolus rohitae*	Southwell et Prashad	1918 : 344–347

Habitat: Branchiae of *Labeo rohita;* Turag river, Mirpur, Dacca district, Bengal (June). Type specimens of Indian Museum P48/1. Infection was heavy. In one case 53 cysts were found on one surface of a single gill.

Vegetative form: Cysts in the gill-filaments. The cysts preserved in alcohol are of a creamy-yellow color, oval to cylindrical in form, lying with the long axis parallel to the gill-filaments. Cysts attached to the gill-filaments with the flattened surface. Size: length 3.1 to 3.8mm.; breadth 0.8 to 1.2mm. Cyst-wall striated vertically, covered with an epithelium, two to three layers thick. In the central portion and at the periphery, mature spores and pansporoblasts as well as immature spores were found respectively. Polysporous.

Spore: Elongated pyriform, rounded at the posterior end and acutely pointed anteriorly. Sutural ridge slightly raised. One polar capsule present, being of conspicuous size. Coiled polar filament is distinctly observed in the polar capsule. An iodinophilous vacuole, 3.6μ in diameter, in the sporoplasm. "Lying just posterior to it is the nucleus of the spore. A few granules of chromatin were also seen lying scattered in the protoplasm." Dimensions: length 30 to 32μ, breadth 7 to 8μ, length of the polar capsule 22 to 23μ, that of polar filament 92 to 97μ.

MYXOBOLUS SENI Southwell et Prashad

[Figs. 375 to 376]

1918	*Myxobolus seni*	Southwell et Prashad	1918 : 347

Habitat: On the median and caudal fins of *Labeo rohita*; Mirpur, Dacca (January). Type specimens in Indian Museum numbered P 53/1.

Vegetative form: Trophozoites form cysts which are elongated ellipsoidal. Size from 4.7mm. to 5.4mm. in length, 2.9mm. to 3.7mm. in breadth. Color of the cyst whitish with black scattered granules on the surface.

Spore: Oval, much wider behind than in front and pointed at the anterior end. Sutural ridge is slightly thickened. A single polar capsule, showing much coiled polar filament. Iodinophilous vacuole 2.3μ in diameter. Dimensions: length 13.2 to 13.6μ, breadth 10.1 to 10.3μ, length of polar capsule 4μ, length of polar filament 43μ (in one case).

MYXOBOLUS MISGURNI nov. spec.

[Figs. 377 to 378]

1916	*Myxobolus fuhrmanni*	Kudo	1916 : 5

Habitat: Gall-bladder of *Misgurnus anguillicaudatus*; Tokio (September). About 50% of the fish examined showed a few isolated spores floating in the bile.

Vegetative form: Unobserved.

Spore: Form elongated pyriform, with attenuated anterior and rounded posterior ends. Shell uniformly thick. Over sutural edge, shell exhibits many (up to 12) triangular markings. Sutural ridge distinct. A single pyriform polar capsule at the anterior end. Sporoplasm contains an iodinophilous vacuole and two nuclei. Coiled polar filament distinct in vivo. Dimensions of fresh spores: length 14 to 15.5μ, breadth 6 to 7.3μ, thickness 5 to 6μ, polar capsule 6.3μ by 2 to 3μ, length of polar filament up to 100μ.

Remarks: The writer reported this species as identical with *Myxobolus fuhrmanni* Auerbach. By repeated reexamination and comparison with Auerbach's description, however, he came to the conclusion that the present form should be treated as a new species, on account of the difference of the host and the characters of the spore.

MYXOBOLUS PFEIFFERI Thélohan

[Figs. 379 to 385]

1890	*Myxosporidian*	Pfeiffer	1890 : 30–37
1891	*Myxosporidian*	Pfeiffer	1891 : 100, 105–110, 130
1893	*Myxosporidian*	Pfeiffer	1893 : 118–130
1895	*Myxobolus pfeifferi*	Thélohan	1895 : 350
1898	*Myxobolus pfeifferi*	Doflein	1898 : 306, 320, etc.
1906	*Myxobolus pfeifferi*	Cépède	1906 : 59
1906	*Myxobolus pfeifferi*	Stazzi	1906 : 14–19
1906	*Myxobolus pfeifferi*	Mercier	1906 : 427–428; 1906a : 763–764
1908	*Myxobolus pfeifferi*	Keysselitz	1908 : 253–273, 286–306
1909	*Myxobolus pfeifferi*	Mercier	1909 : 5–30

Habitat: Muscle and connective tissue of kidney, spleen, intestine, ovary, etc., of *Barbus barbus* L., and branchiae of *B. fluviatilis* Ag. and *B. plebejus* Val.; Drac (June), Neckar, Prag, Milano. The cause of well known "Boil disease" (Beulenkrankheit) or Myxoboliasis tuberosa (Hofer) of the barbels in European waters. Among many observers Keysselitz made a thoro study of the parasite. His observations are as follows: The disease occurs among the fish at any stage of growth. About 8% of the fish, 7 to 15cm. long, caught in May and June between Conz and Trier were infected with the parasites. The heaviest infection, however, occurs among fish up to 40cm. in length; fish 50cm. long or larger show the tumors caused by the parasites, rather rarely. Most of the fish die as the result of the infection between the early part of April and the end of October. The highest mortality is reached in the hottest months, i.e., July and August. The temperature greatly affects the growth of the parasites. Fish kept in the aquarium at a temperature of 25° C. or higher demonstrate the growth of the boil in size daily. The boils are not noticed during the winter and spring, they are formed from the early part of April to the middle of October.

Vegetative form: The parasites develop tumors of conspicuous size.

Keysseltiz's observations are as follows: The tumor varies in size from millet-grains to hen's eggs. Form spherical, oval or elongated. The number of cysts on a single fish, is usually 3 to 4; often one, in some fish, however, 23 were recognized on one fish. Usually tumors separated from each other, rarely many forming one tumor. In one fish, 27cm. in length, a tumor of 7cm. long, 4cm. broad and 3cm. thick, was observed in July. The seat of infection is: the muscle of the body, muscle of pectoral and anal fins, often in peritoneum and rarely in intestine. As the result of breaking up of the cyst membrane, spores are also found in the testis, liver and kidney.

The tumor is composed of many vegetative forms, rounded, oval, elongated, variously branched or flattened. Size reaches to 1.5mm. in diameter. Protoplasm is usually differentiated into ectoplasm and endoplasm. The surface is not often smooth, but shows irregular outline. Ectoplasm is seen often as a very thin, uniformly hyaline, indistinctly granular or radially striated layer, giving the network-like appearance to the surface of the body. Endoplasm, stained more deeply around the peripheral part than other portion, shows a coarsely alveolar structure in the central region. It contains vegetative nuclei, developmental stages of propagative nuclei, granules, fat-like, often leucocytes and red blood corpuscles. The leucocytes, uninuclear or multinuclear, were seen at the periphery, apparently in the course of degeneration. Red blood corpuscles were found, in section, inside of the apparently intact parasite. Each pansporoblast develops into two spores. Polysporous.

Cépède observed one cyst, about 2mm. in diameter, in the connective tissue of the third gill arch.

Spore: Thélohan described as follows: Ovoidal. Sutural edge shows folds. A small triangular intercapsular appendix. Dimensions: length 12μ, breadth 10μ. Cépède's form showed exactly the same dimensions.

Keysselitz gave the characters of the spore as follows:

Flattened oval. Shell smooth. A small intercapsular appendix. Sutural edge having a number of small flat enlargement, size and number being variable. Two convergent narrow canals (foramina) penetrate the shell at the anterior end. Two polar capsules, pyriform and of equal or nearly equal size, are located at the anterior half. Coiled polar filament distinct, coiled 7 to 8 times. No distinct connection between polar capsule and the filament. Sporoplasm fills the posterior half of the spore, extending into intercapsular cavity. It is finely reticular, exhibits one or two rounded or oval vesicular nuclei and an iodinophilous vacuole. Fat-like substance is often seen around the polar capsules. Spores kept in water for four months remain intact in large numbers. Dimensions: length 12 to 12.5μ, breadth 10 to 10.5μ, length of polar capsule, 5.5 to 6μ, length of polar filament 28 to 34μ.

MYXOBOLUS INAEQUALIS Gurley
[Fig. 411]

1841		Müller	1841 : 487–488
1893	*Myxobolus inaequalis*	Gurley	1893 : 414
1894	*Myxobolus inaequalis*	Gurley	1894 : 212

Habitat: In the skin of the head of *Piramutana blochi* Cuv. et Vil. and *Synodontis schall* Bl. Schn.; Guiana, Surinam.

Vegetative form: Very small pustules in the skin of the head.

Spore: Ovoidal. Two polar capsules of unequal size at the anterior end. Dimensions: length 0.0052''', breadth 0.0033'''.

MYXOBOLUS DISPAR Thélohan
[Fig. 386]

1895	*Myxobolus dispar*	Thélohan	1895 : 348
1904	*Myxobolus dispar*	Hofer	1904 : 50
1910	*Myxobolus dispar*	Wegener	1910 : 73–74
1911	*Myxobolus dispar*	Nemeczek	1911 : 145

Habitat: Branchiae of *Carassius carassius* L., branchiae and epithelium of intestine of *Cyprinus carpio* L., also muscle and spleen of *Scardinius erythrophthalmus* L. and in the skin and the connective tissue of *Alburnus lucidus* Heck.; France, Austria, Königsburg (March, July, September).

Vegetative form: Not described by Thélohan.

Wegener's description is as follows: Cysts: white in color; spindle shape with pointed ends. Cysts in *Carassius carassius* L. smaller and oval.

Size 3.5mm. by 0.8mm. Cysts are surrounded by thick layers (7 to 8μ) of the connective tissue of the host. Ectoplasm seems to be undifferentiated. Endoplasm granular, contains a larger number of spores. Polysporous.

Spore: Thélohan's diagnosis is as follows:

Ellipsoidal or slightly oval. Shell with 3 to 5 folds along sutural edge. Polar capsules of unequal size, with a small intercapsular body. The vacuole is difficult to stain with iodine. Dimensions: length 10 to 12μ, breadth 8μ, polar capsule 7μ by 5μ.

Wegener's form is as follows: length 11 to 12μ, breadth 7.5 to 8μ, larger polar capsule 6 to 7μ by 3.5μ, smaller one 4μ by 2.5 to 3μ. The sporoplasm is shifted toward the smaller polar capsule.

MYXOBOLUS ELLIPSOIDES Thélohan

[Figs. 387 to 389]

1852		Remak	1852 : 144–146
1892	*Myxobolus ellipsoides*	Thélohan	1892 : 177
1895	*Myxobolus ellipsoides*	Thélohan	1895 : 350–351
1898	*Myxobolus ellipsoides*	Doflein	1898 : 324, etc.
1905	*Myxobolus ellipsoides*	Nufer	1905 : 77, 79, 186.
1910	*Myxobolus ellipsoides*	Wegener	1910 : 74–75
1912	*Myxobolus ellipsoides*	Lo Giudice	1912 : 1–79

Habitat: Connective tissue of air bladder, branchiae, kidney, spleen, liver and cornea of *Tinca tinca* L., branchiae of *Abramis brama* L., *Alburnus lucidus* Heck., *Leuciscus rutilus* L., *Squalius cephalus* L., *Abramis vimpa* Cuv., *Blicca björkna* L., *Idus melanotus*; France, Vierwaldstätter See, Prague, Masurische See, Italy.

Vegetative form: Thélohan does not describe.

According to Wegener, white cysts, elongated oval; 2mm. by 0.5mm. in size. Polysporous.

Spore: Thélohan described as follows: Flattened elliptical, rather elongated. Sutural edge broad without any folds. Shell with no marking. Form of the spore somewhat variable. Two polar capsules of equal size, capsulogeneous nuclei present even when fully grown. Abnormal spores are of frequent occurrence. Dimensions: length 12 to 14μ, breadth 9 to 11μ, length of polar capsule 4μ.

Wegener's form: length 14 to 15μ, breadth 10 to 11μ, polar capsule 4 to 5μ by 3μ. Shell comparatively thick. One spore had a tail 5μ long.

MYXOBOLUS EXIGUUS Thélohan

[Figs. 390 to 395]

1891	*Myxosporidium mugilis* ?	Perugia	1891 : 23
1895	*Myxobolus exiguus*	Thélohan	1895 : 349–350
1906	*Myxobolus exiguus*	Schröder	1906 : 195
1910	*Myxobolus exiguus*	Wegener	1910 : 75
1912	*Myxobolus exiguus*	Parisi	1912 : 294–295

Habitat: Branchiae of *Abramis brama* L. and *Chondrostoma nasus* L., wall of stomach, pyloric coecum and intestine, branchiae, spleen, kidney of *Mugil chelo* Cuv., *M. capito* Cuv. and *M. auratus* Riss.; Le Vivier-sur-mer, Banyuls, Marseille, Heidelberg, Pregel, Frisches Haff, Kurisches Haff, Geneva, Napoli.

Vegetative form: No description by Thélohan.

Wegener writes as follows:

Cysts of variable size. Color white. Usually small and narrow, 0.5 to 0.7mm. long and 0.2mm. wide. Frequently large round cysts of 1.2 to 1.5mm. in diameter, filling the lamella. Cysts are surrounded by 10 to 11μ thick membrane composed of the connective tissue of the host. Ectoplasm, 5μ thick, is faintly stained by hematoxylin. Outer region of endoplasm, alveolar and densely loaded with nuclei, while in the central portion with mature spores in granular ground-mass.

Parisi's observations are as follows:

Cysts in the intestinal wall of *Mugil auratus*, large; reaching a length of 3mm.

Spore: Thélohan's description is as follows:

Flattened ovoidal, with more or less attenuated anterior end. Sutural edge shows fairly noticeable folds. A small triangular intercapsular appendix. Vacuole in the sporoplasm is usually hard to stain with iodine. Dimensions: length 8 to 9μ, breadth 6 to 7μ, length of polar filament 15μ (KOH).

Wegener observed as follows: Rounded with slightly pointed anterior end. Length 8 to 9.5μ, breadth 6 to 7.5μ, polar capsule 4.5μ by 2 to 3μ. Shell exhibits small folds around the sporoplasm. An intercapsular triangular body indistinctly visible.

Parisi gave the following dimensions: length 8 to 8.5μ, breadth 6 to 7μ, thickness 5.5μ, polar capsule 3 to 4μ by 1.5 to 2μ, length of polar filament 30μ (alkaline). Folds usually 6 in number. Coiled polar filament visible in vivo.

MYXOBOLUS OVIFORMIS Thélohan

[Fig. 396]

1854		Lieberkühn	1854 : 21–22
1892	*Myxobolus oviformis*	Thélohan	1892 : 177
1895	*Myxobolus oviformis*	Thélohan	1895 : 351
1905	*Myxobolus oviformis*	Nufer	1905 : 77, 186
1906	*Myxobolus oviformis*	Cépède	1906 : 60
1910	*Myxobolus oviformis*	Wegener	1910 : 76–78

Habitat: Fin (subcutaneous tissue), spleen, kidney and liver of *Gobio gobio* L.; branchiae of *Alburnus lucidus* Heck., *Cyprinus carpio* L., *Blicca björkna* L., *Abramis brama* L. and *A. vimba* L.; France (Isère), Frisches Haff (especially spring months), Switzerland.

Vegetative form: Thélohan gave no description.

Wegener's observations are as follows:

Cysts, white, 0.75 to 1.7mm. by 0.4 to 0.7mm. In sections, cysts are shown to be surrounded by a thick (10 to 20μ, average 16μ) layer of connective tissue. Ectoplasm a thin (6 to 8μ thick) layer, exhibits a transverse striation. The striation is often absent at places in ripe cysts. Endoplasm finely granular. In young cysts, it is, however, reticulated, with nuclei of 1.5μ in diameter.

Spore: Thélohan described as follows: Flattened ovoidal with pointed anterior end. Shell smooth. No folds. Polar capsule comparatively large. Dimensions: length 10 to 12μ, breadth 9μ, polar capsule 6μ.

Cépède observed numerous spores in the liver and kidney of *Gobio gobio*. Dimensions in vivo: length 10 to 12μ, breadth 9μ, length of polar capsule 6μ. Polar capsules of equal size. Coiled polar filament distinct.

Wegener's form: length 10.5 to 11μ, breadth 7.5 to 8μ, polar capsule 5 to 6μ by 3μ.

Remarks: Wegener recognized another form, which seems to be of very rare occurrence and which can not be distinguished distinctly from the above described form. Cysts at the end of the branchial lamellae. Size 1.7 to 2mm. in largest length. Spore resembles more closely the figure given by Thélohan for *Myxobolus oviformis* than the above mentioned form which he observed. A small intercapsular appendix (rounded) indistinct. Sporoplasm comparatively small. Length 12.5 to 13.5μ, breadth 9μ, polar capsule 7.5μ by 3μ.

MYXOBOLUS LINTONI Gurley

[Figs. 404 to 408]

1891		Linton	1891 : 99–102
1893	*Myxobolus lintoni*	Gurley	1893 : 414
1894	*Myxobolus lintoni*	Gurley	1894 : 238

Habitat: Superficial musculature and subcutaneous tissue of *Cyprinodon variegatus*; Woods Hole (August).

Vegetative form: Cysts, not closed, but fungoid masses of an irregular shape, varying in size from 4mm. by 2.5mm. to 10mm. by 4mm., projecting as much as 3mm. above general surface of skin. The skin of the host overlying these tumors, is more or less cracked and broken, the scales being scattered.

Spore: Elliptical in the front view; lenticular in side view. Shell thick. Sutural ridge marked. Two polar capsules, convergent, at the anterior end. Spores kept in alcohol, extruded polar filaments under the action of iodine water and sulphuric acid. Sporoplasm with a large iodinophilous vacuole. Dimensions: length 13.9μ, breadth 11μ, thickness 8μ.

MYXOBOLUS GLOBOSUS Gurley
[Figs. 409 and 410]

1893	*Myxobolus globosus*	Gurley	1893 : 415
1894	*Myxobolus globosus*	Gurley	1894 : 241

Habitat: Branchial lamellae of *Erimyzon sucetta oblongus* Lac. (*Catostomus tuberculatus* Le Sueur); Kinston (N.C.), Columbia, (S.C., March), tributaries of Fox River.

Vegetative form: Cysts, whitish, elongated elliptical or rod-shaped, surrounded by very thin membrane? Size up to 0.5mm. in max. length. Polysporous.

Spore: Globose, subcircular in outline. Shell thin and very transparent. Sutural ridge very wide, being one third of the thickness of the spore. Polar capsules two, of equal size, divergent. Vacuole present, but not clearly contoured. Dimensions: length 7 to 8μ, breadth 6 to 7μ, thickness 5μ.

MYXOBOLUS OBLONGUS Gurley
[Figs. 412 to 416]

1841		Müller	1841 : 487–490
1893	*Myxobolus oblongus*	Gurley	1893 : 414
1894	*Myxobolus oblongus*	Gurley	1894 : 234–238

Habitat: Beneath the skin, chiefly of the head of *Erimyzon sucetta oblongus* Lac. (*Catostomus tuberculatus* Le Sueur); Kinston, tributaries of Fox River.

Vegetative form: Cysts, round or elliptic, not over 1mm. in diameter, covered by resistant membrane. Color whitish. Polysporous.

Spore: Spatular, approaching roundish-oblong. Shell thin and transparent. Sutural ridge wide. Two polar capsules, pyriform, of equal size. Sporoplasm extending forward along the upper surface. Vacuole could not be detected. Dimensions: length 14 to 17μ, breadth 8.5μ, thickness 5 to 6μ.

MYXOBOLUS TRANSOVALIS Gurley
[Figs. 417 and 418]

1893	*Myxobolus transovalis*	Gurley	1893 : 415
1894	*Myxobolus transovalis*	Gurley	1894 : 242

Habitat: Under scales on external surface of *Phoxinus* (*Clinostomus*) *funduloides* Girard; 4 Mile Run, Carlius, Va., tributary of Potomac River (June). No fish of the same species caught from the same locality on August 29 of the same year was found infected.

Vegetative form: It is not certain whether cysts exist or not. Spores in mass, appear to be held together by a small gelatinous or mucoid mass which has no attachment to the subjacent connective tissue. It forms a thin discoidal mass situated in the center of the concave surface of the scale. The color of the mass slightly more yellowish than the surrounding tissue, when coagulated. It is exceedingly difficult to detect its presence in the fresh state.

Spore: Elliptical, with the largest diameter passing thru two polar capsules. Shell thin. Sutural edge narrow. Two polar capsules of equal size convergent. Polar filament is extruded under the action of glycerine and sulphuric acid. The vacuole in the sporoplasm is difficult to detect. Sporoplasm also contains two nuclei, rarely one, 1 to 1.5μ in diameter. Dimensions: length 6 to 7μ, breadth 8μ.

MYXOBOLUS OBESUS Gurley
[Figs. 419 and 420]

1883		Balbiani	1883 : 203
1893	*Myxobolus obesus*	Gurley	1893 : 415
1894	*Myxobolus ? obesus*	Gurley	1894 : 239
1899	*Myxobolus obesus*	Labbé	1899 : 100
1906	*Myxobolus obesus*	Cépède	1906 : 60–61

Habitat: On *Alburnus alburnus* L.; branchiae and kidney of *A. lucidus* Heck. (*A. mirandella* Bl.); Lac du Bourget.

Vegetative form: Balbiani gave no observation.

Cépéde observed as follows: Cysts, ovoidal, more or less elongated or variable in form, not exceeding 800μ in length. In kidney, numerous cysts were of subspherical, ovoidal or rarely irregularly elongated form. Subspherical cysts 500 to 600μ in average diameter. Polysporous.

Spore: Cépède describes as follows: Subcircular or ovoidal in front view; lenticular in side view. Sutural edge exhibits variable numbers (4 to 5) of fold-like markings on the shell. Polar capsules pyriform and of equal size. Coiled polar filament distinct. A small triangular intercapsular appendix. Sporoplasm with a subspherical and clearly outlined vacuole and two nuclei. Dimensions in vivo: length 11.5 to 12μ, breadth 7.5 to 8μ, thickness 5μ. Those of fixed and stained spores: length 11.25 to 11.50μ, breadth 7.25 to 7.50μ, length of polar capsule 5μ.

Remarks: Cépède mentions that *Alburnus alburnus* L. mentioned by Gurley is "without doubt" identical with *A. lucidus* Heckel.

MYXOBOLUS CYCLOIDES Gurley
[Fig. 421]

1841		Müller	1841 : 481, 486
1893	*Myxobolus cycloides*	Gurley	1893 : 415
1894	*Myxobolus cycloides*	Gurley	1894 : 239
1906	*Myxobolus cycloides*	Cépède	1906 : 61–63
1910	*Myxobolux cycloides*	Wegener	1910 : 79–80

Habitat: Opercle, pseudobranchiae and kidney of *Leuciscus rutilus*; branchiae of *Scardinius erythrophthalmus*, *Blicca björkna* L., *Gobio gobio* L., *Abramis vimba* L., *A. brama* L., *Rhodeus amarus* Bl., *Alburnus alburnus* L., *Lota lota* L.; France (Isère), Germany (Pregel, Frisches and Kurisches Haff, Masurische See, January, May).

Vegetative form: Wegener observed cysts as follows. A type: 1 to 2mm. by 0.4 to 0.7mm. Form exactly like that of *Myxobolus oviformis*. B type: small and round, present in groups. C type: small 0.5mm. by 0.2mm.

Spore: Gurley gave the following short diagnosis from the observations of J. Müller: subcircular-ovate or broadly rounded elliptic, length 12μ.

Cépède distinguishes three different types of spores as follows: Lenticular in side view; subcircular (13.5μ by 13μ), oval (14.7μ by 11.4μ) and ovoidal (16μ by 11μ) in front view. Two polar capsules of equal size (6μ by 4μ), closely set or separated (3μ apart) from each other. Coiled polar filament distinct. A small triangular intercapsular appendix. Sporoplasm refractive and finely granular. Sutural edge exhibits folds of variable number at the posterior portion. Dimensions of fixed and mounted spores: length 10.5 to 12μ, breadth 7.5 to 8μ.

Wegener, without noticing Cépède's paper, also mentions three different types chiefly distinguished by the spore as follows:

A type (common form), in the branchiae of *Lota lota*, *Abramis brama*, *A. vimba*, *Blicca björkna*, *Leuciscus rutilus*, *Alburnus alburnus* and *scardinius erythrophthalmus*. Cysts mentioned above.

Spore. Rounded or oval; flattened. A tail, 15μ long, was noticed twice. A triangular intercapsular appendix. Sutural edge usually having folds. Polar capsules often differ in form and size in different cysts, tho they are constant in one and the same cyst, causing the variability in size of sporoplasm. Dimensions: length 11 to 12.5μ, breadth 8 to 9μ, polar capsule 4.5 to 6μ by 3 to 3.7μ, in many cysts 7.5μ by 4μ.

B type. In the fifth gillarch of *Gobio gobio* L. Cysts mentioned above.

Spore. Elongated oval. A triangular intercapsular appendix. Indistinct folds on sutural edge. Dimensions: length 12.5 to 13.5μ, breadth 8 to 10μ, polar capsule 5 to 6μ by 3 to 4μ.

C type. In the branchiae of *Rhodeus amarus* Bl. and *Alburnus alburnus* L. (April and May). Cysts mentioned above.

Spore. Rounded. Distinct intercapsular appendix. Folds distinct on sutural edge. Dimensions: length 12 to 15μ, breadth 9 to 10μ, polar capsule 5 to 7μ by 3 to 4μ.

MYXOBOLUS SPHAERALIS Gurley

1874		Claparède	1874 : 113–114
1893	*Myxobolus sphaeralis*	Gurley	1893 : 415
1894	*Myxobolus sphaeralis*	Gurley	1894 : 240

Habitat: Mucosa of branchiae of *Coregonus lavaretus* L. (*C. fera*); Lake Geneva.

Vegetative form: Cysts, 0.25 to 0.33mm. in diameter. Polysporous.

Spore: Spherical, 9μ in diameter.

MYXOBOLUS ANURUS Cohn
[Figs. 422 and 423]

1895	*Myxobolus anurus*	Cohn	1895 : 42–43
1896	*Myxobolus anurus*	Cohn	1896 : 266
1899	*Henneguya psorospermica anura*	Labbé	1899 : 102
1910	*Myxobolus anurus*	Wegener	1910 : 76
1911	*Henneguya psorospermica anura*	Nemeczek	1911 : 146

Habitat: Branchiae of *Esox lucius* L.; Königsberg (March, December), Frisches Haff, Pregel, Masurische See, Lotzen, (September, October).

Vegetative form: Cysts small rounded and of white color. Cohn measures length 0.6mm., breadth 0.34mm. Wegener's form: length 0.3 to 0.5mm, and breadth 0.2 to 0.3mm.

Spore: Cohn's descriptions are as follows: More or less oval. Dimensions: length 12 to 15μ, breadth 4 to 6.8μ, polar capsule 5.5 to 7μ by 2.1 to 2.5μ, length of polar filament 32 to 38μ.

Wegener's form: Elongated and narrow, often with a tail. Dimensions: length 15μ (maximum up to 18μ), breadth 6 to 7μ, polar capsule 8μ by 3μ.

Remarks: Tho Labbé classified this as a subspecies of *Henneguya psorospermica* Thélohan, Wegener's observation gives stronger basis for placing this form in the genus Myxobolus.

MYXOBOLUS sp. Gurley
[Fig. 424]

1882		Bütschli	1882 : 590
1894	*Myxobolus* sp. incert.	Gurley	1894 : 214
1899	*Myxobolus* sp.	Labbé	1899 : 100

Habitat: *Nais lacustris* L. (*N. proboscidea*); Locality?

Vegetative form: Cysts, 8mm. by 4.25mm. Polysporous.

Spore: Oval or circular; tailed or untailed. These spores of different form occur, often, without order in the same cyst.

MYXOBOLUS sp. Gurley
[Fig. 425]

1894	*Myxobolus* sp. incert.	Gurley	1894 : 239

Habitat: Body cavity of *Carassius carassius* L.; Leipsic.

Vegetative form: Not observed.

Spore: Broadly elliptic; shell bivalve; valves equally convex. Sutural ridge. Two equal polar capsules. Sporoplasm with a vacuole. Dimensions: length 14μ, breadth 10μ, thickness 5μ.

Remarks: This species seems to be very similar to *M. carassii* Klokačewa (page 150).

MYXOBOLUS sp. Gurley
[Figs. 426 to 429]

1841		Müller	1841 : 480
1894	*Myxobolus* sp.	Gurley	1894 : 240–241
1899	*Myxobolus* sp.	Labbé	1899 : 100

Habitat: Skin of opercle, in the branchiae, on the head or on the fin of *Lucioperca lucioperca* L.; Germany, Don.

Vegetative form: Cysts 1.09 to 2.18mm. in diameter. Color whitish. Polysporous.

Spore: Rounded. Thickness equal to half the breadth. Sutural ridge. Two polar capsules, of equal size, converging.

MYXOBOLUS CYPRINI Doflein
[Figs. 430 to 432]

1896		Hofer	1896 : 2, 38–39
1898	*Myxobolus cyprini*	Doflein	1898 : 288, 320, 325
1904	*Myxobolus cyprini*	Hofer	1904 : 66–67
1909	*Myxobolus cyprini*	Doflein	1909 : 780–783
1916	*Myxobolus cyprini*	Doflein	1916 : 1026-1027

Habitat: Suppurative connective tissue and epithelium of kidney, liver and spleen of *Cyprinus carpio* L., rarely *Tinca vulgaris* Cuv. and *Abramis brama* L.; Germany, Austria. According to Hofer the parasites cause so-called "small pox of carp" among carp in German waters.

Vegetative form: Small ameboid. Form irregular. The youngest form with a single or many nuclei, is found in the epithelium of the kidney. Multiplication by multiple division, the nuclei undergoing amitotic division. Endoplasm contains homogeneous, yellow and refractive bodies. Also found in the state of diffuse infiltration. Spores are found in the parenchym of the kidney.

Spore: Oval. Shell thickened (1.5μ wide) along the sutural edge. Two converging polar capsules cross each other, in front view, at the anterior tip. Sporoplasm with an iodinophilous vacuole. Dimensions: length 21μ, breadth 15μ, length of polar capsule 6μ. Doflein (1916:1027) gives the following dimensions: length 10 to 16μ, breadth 8 to 9μ.

Hofer gives the following dimensions: length 10 to 12μ (up to 16μ), breadth 8 to 11μ, polar capsule 5 to 6μ by 3μ, sutural edge 1.5μ.

MYXOBOLUS NEUROBIUS Schuberg et Schröder

[Figs. 433 to 436]

1905	*Myxobolus neurobius*	Schuberg and Schröder	1905 : 49–56

Habitat: Nervous tissue of *Trutta fario* L.; Gutach (May?).

Vegetative form: Cysts, usually elongated, often spherical. Elongated form 0.9mm. by 0.02mm. The seat of the cysts is between the medullary sheath and sheath of Schwann. Neither medullary sheath nor axis-cylinder was infected. Cyst-membrane could not be made out. Cysts contained only full-grown spores without any younger stage. Polysporous.

Spore: Broad oval in front view; spindle shaped in side view. Anterior end attenuated, posterior end rounded. Shell somewhat thick. Sutural ridge is not particularly marked. Edge without any fold. No intercapsular appendix. Sporoplasm, with a large and spherical iodinophilous vacuole and a single nucleus, occupies less than one half of the inner space of the spore. Two polar capsules, pyriform, fuse into one at the anterior end. Coiled (8 to 10 times) polar filament distinct. Dimensions: length 10 to 12μ, breadth 8μ, thickness 6μ, polar capsule 6 to 7μ by 2μ.

MYXOBOLUS AEGLEFINI Auerbach

[Figs. 437 to 441]

1906	*Myxobolus aeglefini*	Auerbach	1906 : 568–570
1906	*Myxobolus aeglefini*	Auerbach	1906a : 115–119
1907	*Myxobolus esmarkii*	Johnstone and Woodcock	1907 : 204–208
1909	*Myxobolus aeglefini*	Auerbach	1909 : 76–78
1910	*Myxobolus aeglefini*	Auerbach	1910c : 181–182
1911	*Myxobolus aeglefini*	Nemeczek	1911 : 162

Habitat: Cartilage and bone of cranium and eye of *Gadus aeglefinis* *G. callarias*, *G. merlangus* L., *G. morrhua* L., *G. esmarkii* and *Molva vulgaris* Flem.; Norway, Morecambe (March).

Vegetative form: Cysts in cartilage and bone of cranium and in cartilagineous layer of the sclerotic of the eye. Protoplasm is distinctly differentiated. Ectoplasm somewhat vacuolated; endoplasm granular with numerous small nuclei. Polysporous.

Johnstone's observations are as follows: Round the peripheral part of the cornea, and covered loosely by conjunctiva are a number of milk-white rounded or oval bodies, from about 1 to 3mm. in diameter. Several of these fused to form elongated mass which lie along the curvature of the periphery of the eye. These cysts also invade the lateral and posterior parts of the bulbus oculi. In sections, the cysts lie within the thickness of cartilaginous layer of the sclerotic. This latter is enlarged into thick layer (2mm.) by the presence of the cysts.

Nemeczek mentions irregular cysts of 1.5mm. in diameter.

Spore: Elliptical in front view. Two polar capsules convergent. No intercapsular appendix. Sutural edge rather thick with a number of folds on the posterior margin. Sporoplasm with two nuclei and an iodinophilous vacuole. Dimensions: length 10.8 to 11.7μ, breadth 9.9 to 10.4μ, thickness 7.2 to 9μ, length of polar capsule 4.5 to 5μ.

Woodcock's form has a spore with the following characters:

Slightly ovoid. Sporoplasm always contains a large and well defined vacuole and two nuclei. Dimensions: length 10μ, breadth 8μ, length of polar capsule 3.25 to 3.5μ.

MYXOBOLUS GIGAS Auerbach

[Figs. 442 to 445]

1906	*Myxobolus gigas*	Auerbach	1906 : 386–391
1910	*Myxobolus gigas*	Auerbach	1910c : 182
1912	*Myxobolus gigas*	Parisi	1912 : 293–294

Habitat: Subcutaneous connective tissue of the operculum of *Abramis brama* L.; Karlsruhe, Pavia. Parisi observed cysts on the side, on the caudal fin (5 cysts on rays), on other fins, branchiae and in the internal organs of the fish.

Vegetative form: Cysts, spherical or ovoidal. No cyst membrane composed of the connective tissue of the host. Protoplasm is indistinctly differentiated. Ectoplasm thin and radially striated, which gradually turns into endoplasm. Endoplasm finely granular, contains numerous nuclei (2.5 to 2.7μ in diameter). Size of greatest form 360μ by 290 to 300μ. According to Parisi size up to 1.5mm.

Spore: Elliptical when viewed from the front. Sutural edge somewhat narrow, having a number of folds at the posterior portion. Sporoplasm with an iodinophilous vacuole and two nuclei. Dimensions: length 16.9 to 21.6μ, breadth 13 to 16.2μ thickness 9μ, length of polar capsules 7.8μ, length of polar filament 90μ (sulphuric acid).

Parisi gives 150μ for the length of polar filament.

MYXOBOLUS VOLGENSIS Reuss

[Figs. 446 to 448]

1906	*Myxobolus volgensis*	Reuss	1906 : 200–201

Habitat: Branchiae, cornea and dorsal fin of *Lucioperca volgensis* Pall; Volga.

Vegetative form: Cysts, spherical, 0.3 to 1mm. in diameter. Polysporous.

Spore: Broad elliptic or rounded. Sutural edge has at least 3 folds. Sporoplasm with an iodinophilous vacuole. Dimensions: length 8.25 to 9.5μ, breadth 7.25 to 8.25μ, thickness 4.5 to 5.5μ, polar capsule 3μ by 2μ.

MYXOBOLUS SCARDINII Reuss

[Fig. 449]

1906 *Myxobolus scardinii* Reuss 1906 : 201

Habitat: Branchiae of *Scardinius erythrophthalmus* L.; Volga.

Vegetative form: Cysts, elongated oval. Smaller cysts rounded oval, 0.8mm. by 0.5mm., the larger forms elongated, 1.2mm. by 0.5mm. Polysporous.

Spore: Broad elliptical. Sutural edge narrow, having folds. A larger triangular intercapsular process. An iodinophilous vacuole in sporoplasm. Dimensions: length 11 to 12μ, breadth 9 to 9.5μ, thickness 4.5 to 5μ, polar capsules 5μ by 2.5μ.

MYXOBOLUS PHYSOPHILUS Reuss

[Figs. 450 and 451]

1906 *Myxobolus physophilus* Reuss 1906 : 201–202

Habitat: Surface of air bladder of *Scardinius erythrophthalmus* L.; Volga.

Vegetative form: Cysts, rounded, 1.5mm. in diameter. Polysporous.

Spore: Oval, with attenuated anterior end. Sutural edge narrow and smooth. Polar capsules rather large. An iodinophilous vacuole in sporoplasm. Dimensions: length 12 to 13μ, breadth 8.25 to 9μ, thickness 6.5 to 7μ, polar capsules 6μ by 2.5μ.

MYXOBOLUS MACROCAPSULARIS Reuss

[Fig. 452]

1906 *Myxobolus macrocapsularis* Reuss 1906 : 202

Habitat: Branchiae of *Blicca björkna* L.; Volga.

Vegetative form: Cysts, Elongated oval. Size: 1mm. by 0.5mm. Polysporous.

Spore: Oval with greatly attenuated anterior portion. Sutural edge broad and without any fold. Polar capsules rather large. An iodinophilous vacuole in sporoplasm. Dimensions: length 11 to 13μ, breadth 8.25 to 9.25μ, thickness 5.5μ, polar capsules 6μ by 2.5 to 3μ.

MYXOBOLUS SANDRAE Reuss

[Fig. 453]

1906 *Myxobolus sandrae* Reuss 1906 : 202–203

Habitat: Muscle of *Lucioperca sandra* Cuv.; Volga.

Vegetative form: Cysts. Rounded, 0.5mm. in diameter. Polysporous.

Spore: Oval. Sutural edge broad with many distinct folds. An iodinophilous vacuole in sporoplasm. Dimensions: length 9.25 to 10μ, breadth 7.25 to 8.25μ, thickness 4 to 5μ, polar capsules 3.5μ by 2μ.

MYXOBOLUS BRAMAE Reuss
[Fig. 454]

1906 *Myxobolus bramae* Reuss 1906 : 203–204

Habitat: Branchiae of *Abramis brama* L.; Volga.

Vegetative form: Cysts. Oval, 0.5mm. long, 0.25mm. broad. Polysporous.

Spore: Oval to nearly spherical. Sutural edge narrow and with indistinct folds. Two polar capsules, with a small triangular intercapsular process. An iodinophilous vacuole. Dimensions: length 11 to 12μ, breadth 9.25 to 10μ, thickness 4.5 to 5.5μ, polar capsules 4 to 5μ by 2.25μ.

MYXOBOLUS CYPRINICOLA Reuss
[Fig. 456]

1906 *Myxobolus cyprinicola* Reuss 1906 : 204

Habitat: Branchiae of *Cyprinus carpio* L.; Volga.

Vegetative form: Cysts, oval, 0.5mm. by 0.3mm. Polysporous.

Spore: Elongated oval. Sutural edge narrow with many indistinct folds. An iodinophilous vacuole. Dimensions: length 9.25 to 10μ, breadth 7 to 7.25μ, thickness 5 to 5.5μ, polar capsules 4.5μ by 2.5 to 3μ.

MYXOBOLUS BALLERI Reuss
[Fig. 455]

1906 *Myxobolus balleri* Reuss 1906 : 204–205

Habitat: Branchiae of *Abramis ballerus* L.; Volga.

Vegetative form: Cysts. Elongated, 1.5mm. by 0.5mm. Polysporous.

Spore: Oval, slightly pointed at the anterior end. A triangular intercapsular appendix. Sutural edge smooth. An iodinophilous vacuole. Dimensions: length 11 to 12μ, breadth 9.25 to 10μ, thickness 5.5 to 6.5μ, polar capsules 5.5μ by 2.75μ.

MYXOBOLUS SQUAMAE Keysselitz
[Figs. 457 to 459]

1908 *Myxobolus squamae* Keysselitz 1908 : 273–274

Habitat: Inner surface of the scales of *Barbus fluviatilis* Agass.; Mosel and Neckar.

Vegetative form: Form variable; rounded, oval, elongated or rarely branched. The outline of the body is not smooth but irregular with numerous small tooth-like projections with which the body comes in contact with the surrounding substance. The parasites seem to be able to dissolve the substance composing the scale. Length 50 to 800μ. In one scale, one or many, up to 8, individuals were found. All showed only advanced stages of spore formation. The parasites are surrounded by a variously developed envelope of connective tissue. Polysporous.

Spore: Elongated oval. Two polar capsules, with 7 to 8 times coiled polar filament. A triangular intercapsular projection. Sporoplasm with an iodinophilous vacuole. Dimensions: length 10 to 10.5μ, breadth 8 to 8.5μ, length of polar capsule 4.5μ.

MYXOBOLUS CORDIS Keysselitz
[Figs. 460 and 461]

1908	*Myxobolus cordis*	Keysselitz	1908 : 279–282

Habitat: Muscle of ventricle, rarely that of bulbus arteriosus of *Barbus fluviatilis* Ag., spores found in kidney, liver and spleen in the condition of somewhat scattered infiltration; Germany (Mosel and Neckar).

Vegetative form: Elongated, oval, sausage or club form. The body whitish, later yellowish. Size from 0.25 up to 4mm., usually 1 to 1.5mm. in length. Propagative stage and cysts observed. One end of the body is held more or less deeply in the muscle and is covered by cellular envelope as in *Myxobolus musculi*, while remaining larger portion of the body is suspended freely inside of the ventricle, covered with a thin layer probably of endocardiac cells. Fish 30 to 45cm. long harboured 40 to 60 parasites. No movements. Ultimately the cysts are formed with differentiated protoplasm. Polysporous.

Spore: Oval. Shell very thin at the anterior end. At the posterior end, cell-like appendage, 2 to 3μ wide which is probably formed by both valves, is present. Two pyriform polar capsules at the anterior end, which show the polar filament coiled 7 to 8 times. Sporoplasm with a comparatively large and oval iodinophilous vacuole and two nuclei, rarely one (syncaryon). Dimensions: length 12μ, breadth 10μ, length of polar capsule 4.5μ.

MYXOBOLUS MUSCULI Keysselitz
[Figs. 462 to 464]

1908	*Myxobolus musculi*	Keysselitz	1908 : 282–286

Habitat: Muscle of the main body, rarely that of fins and operculum, and kidney of *Barbus fluviatilis* Agass. of various size (youngest fish found infected, 2 months old), spores in liver, spleen, kidney and ovary (not the ovum) in diffuse infiltration; Mosel and Neckar.

Vegetative form: Elongated. Body whitish opaque, with differentiated protoplasm. Smallest individual observed, 24μ. Large form 2mm. in length. Many trophozoites are found closely situated, forming a large mass of parasites that reached dimensions of 4mm. by 2mm. The surrounding envelope, varying in thickness, composed of cells with elongated nuclei as those of perimysium. Young cysts surrounded by thin layer of ectoplasm. Polysporous.

Spore: Oval. Two polar capsules usually unequal. Shell as in *M. cordis* with a small peg closer to the anterior end, polar filament coiled 4 to 5 times, visible in the capsule. Sporoplasm with rarely one (syncaryon), but usually two nuclei and an iodinophilous vacuole. A posterior process as is seen in the spores of *M. cordis*, but much smaller, was occasionally observed. Dimensions: length 11μ, breadth 8μ, polar capsules 6μ and 4μ long.

MYXOBOLUS sp. Miyairi

1909 *Myxobolus* sp. Miyairi 1909 : 126

Habitat: Branchiae of loach (*Misgurnus anguillicaudatus* Cant.?); Fukuoka? (Nippon).

Vegetative form: Cysts were not observed.

Spore: No description.

MYXOBOLUS sp. Wegener
[Fig. 465]

1910 *Myxobolus* sp. Wegener 1910 : 78

Habitat: Branchiae (gill-arch) of *Perca fluviatilis* L.; Germany (Frisches Haff, March). Only one case.

Vegetative form: Cysts on a gill-arch, white and round, with a diameter of 1.1mm. Polysporous.

Spore: Form and size very variable. Rounded or elliptical, pointed at the anterior end. Sutural edge showing folds at the posterior portion. Dimensions: length 8 to 10μ (in round form) and 11μ (in elliptical form), breadth 8 to 9μ, polar capsules 4 to 5μ by 2 to 3μ, length of polar filament 40μ.

MYXOBOLUS PERMAGNUS Wegener
[Fig. 466]

1910 *Myxobolus permagnus* Wegener 1910 : 78–79

Habitat: Branchiae and operculum of *Perca fluviatilis* L., air bladder of *Scardinius erythrophthalmus* L.; Königsberg (May), Pregel (March).

Vegetative form: Cysts rounded in form and white in color, resemble to those of *M. gigas*. No clear ectoplasm layer, nor typical protoplasmic structure. Polysporous.

Spore: Oval, sharply pointed at the anterior end. Sutural edge with 5 to 6 distinct folds at the posterior portion. Polar filament visible in the polar capsules. Dimensions: length 17 to 18μ, breadth 10 to 13μ, polar capsules 7 to 8μ by 3.5 to 4μ.

MYXOBOLUS ROTUNDUS Nemeczek
[Fig. 467]

1911 *Myxobolus rotundus* Nemeczek 1911 : 156–157

Habitat: Branchiae of *Abramis brama* L.; Austria.

Vegetative form: Cysts, ovoidal or spindle form, 1 to 3mm. long and 1 to 1.5mm. wide. Body white. An extraordinary large number of spores were found in the cysts. Polysporous.

Spore: Round or slightly oval, when viewed from the front. Greatly flattened in side view. Polar capsules convergent, with no intercapsular body. Shell smooth. Sutural edge narrow, without folds. Dimensions: length 10μ, breadth 9.8μ, thickness 3μ, polar capsules 3.8 to 5μ long, length of polar filament 40μ.

MYXOBOLUS MINUTUS Nemeczek

[Fig. 468]

1911	*Myxobolus minutus*	Nemeczek	1911 : 160

Habitat: Branchiae of *Leuciscus* sp.; Austria.

Vegetative form: Cysts spherical, oval or elongated with white color. Size: 0.5 to 3mm. by 0.5 to 1mm. Polysporous.

Spore: Rounded oval, similar to that of *Myxobolus rotundus*. Shell smooth. Sutural edge narrow without folds. Sporoplasm with an iodinophilous vacuole. No intercapsular appendix. Dimensions: length 6μ, breadth 4.2 to 5μ, polar capsule 3μ by 2μ, length of polar filament 50 to 60, often 70μ.

MYXOBOLUS sp. Lebzelter

1912	*Myxobolus* sp.	Lebzelter	1912 : 296–297

Habitat: Gall-bladder of *Thymallus thymallus* L.

Vegetative form: Not observed.

Spore: Sutural ridge distinct. Dimensions, length 5μ, breadth 3μ.

MYXOBOLUS MAGNUS Awerinzew

[Figs. 469 and 470]

1913	*Myxobolus magnus*	Awerinzew	1913 : 75–76

Habitat: Eye of *Acerina cernua* L.; Petrograd.

Vegetative form: Trophozoites form white spots in the tissue of iris, with many spores (300 to 400). Each pansporoblast forms in most cases two, sometimes 3 or 5 spores! Polysporous.

Spores: Large, elongated roundish, slightly flattened. Sutural edge somewhat thick, forming a wide ridge, with 4 to 5 folds at the posterior portion. Polar capsules do not cross each other. Sporoplasm with an iodinophilous vacuole and two nuclei. Dimensions: length 38 to 45μ, breadth 32 to 38μ, thickness 28 to 35μ, length of polar capsules 15 to 17μ, diameter of the vacuole 12 to 16μ.

MYXOBOLUS CARASSII Klokačewa

[Figs. 471 to 473]

1914	*Myxobolus carassii*	Klokacewa	1914 : 182–184

Habitat: Body cavity, liver and intestine of *Carassius vulgaris* L.; Petrograd?

Vegetative form: Cysts spherical. Those in liver and intestine yellowish, surrounded by an envelope composed of fibrous connective tissue. Secondary cysts are formed. Polysporous.

Spore: Oval, in front view. Two ovoidal polar capsules convergent at the slightly attenuated anterior end. Coiled polar filament visible. Sporoplasm with an iodinophilous vacuole and two nuclei. Sutural edge shows folds in some cases. Dimensions: length 13 to 17μ, breadth 8 to 10μ, thickness 5 to 7μ, polar capsules 6 to 7μ long.

Remarks: Compare with *Myxobolus* sp. Gurley on page 142.

MYXOBOLUS sp. Southwell

1915	*Myxobolus* sp.	Southwell	1915 : 312–313

Habitat: Subcutaneous intermuscular tissue of *Rasbora* (*Cyprinus*) *daniconius* Day; from a stream near Katwan, Mirzapore (U.P.), India.

Vegetative form: 6 cysts found on four fish. The seat is immediately below the scales, in the epidermis. Color milky white. Soft, flattened and roughly oval in shape. Greatest length found, 1.1mm. No pigment was present on the cyst.

Spore: Two equal capsules, with a very short tail-like process. Sporoplasm with vacuole; iodine treatment could not be carried out. Dimensions: length 13μ, breadth 13μ, polar capsule 4μ by 4μ(?).

Remarks: Dimensions, especially that of polar capsule seem to be misprinted. Southwell gave one figure of a fish with a cyst near the dorsal fin. He thinks that "it is quite possible that our parasites may belong to *Myxobolus cyprini*." The incomplete observation without any figure, leads the writer to leave the form also as *Myxobolus* sp. Southwell.

MYXOBOLUS FUNDULI Kudo

[Figs. 474 to 476]

1915	*Myxobolus musculi*	Hahn	1915 : 201–205
1917	*Myxobolus musculi*	Hahn	1917 : 91–104

Habitat: Branchiae and muscle of *Fundulus heteroclitus*, *F. majalis*; Woods Hole. Hahn claims that he succeeded in causing experimental infection in *F. diaphanus* and *Cyprinodon variegatus* by inoculation.

Vegetative form: Hahn uses quite a number of different terms from those that are ordinarily used in describing Myxosporidia, without giving any definitions. Naturally it is hard to put what he wrote in several pages in the following lines. Granular vegetative forms produce a great many pansporoblasts, each with a single spore. "Trophoplasm" is difficult to stain. Size: 74 by 33μ, 24 by 19μ. Cysts within and between the muscle fibers, containing several hundred spores.

Spore: Hahn's descriptions may be summarized as follows: Dimensions: length 14.3μ, breadth 6.7μ, thickness 6.7μ to 2/3 of width, polar capsule, 6.5μ by 2μ, polar filament 3 to 4 times the length of the spore (42.9 to 57.2μ). Polar filament coiled 10 to 14 times. Shell thin, almost invisible. The spores found in the gill: length 12 to 13.4μ, breadth 6μ to 10.4μ. A vacuole is present in the sporoplasm.

Remarks: Examination of Hahn's first paper suggested that he was dealing with the present form as a new species tho he did not mention at all Keysselitz who gave the name *Myxobolus musculi* Keysselitz to the parasite of *Barbus fluviatilis* from German rivers. I was informed by Hahn that he gave the name, *Myxobolus musculi*, without knowing the fact that it was preoccupied by Keysselitz (1908) (see page 148) and that tho he became aware of it later, he can not determine differences by which the two forms can be distinguished. A comparison of the descriptions of Keysselitz and Hahn, however, shows that these two forms differ in several respects. Hence the latter form is recorded here as a distinct species under the new name.

It is interesting to note that very similar forms, one without an iodinophilous vacuole at any stage of spore-formation (*Myxosoma funduli* Kudo, see page 125) and the other with a vacuole, occur in the same hosts in the same locality. As mentioned above, the reader is requested to refer to Hahn's original paper for further data.

MYXOBOLUS PLEURONECTIDAE Hahn

[Fig. 477]

1917	*Myxobolus pleuronectidae*	Hahn	1917 : 160–161

Habitat: Subcutaneous muscular tissue of *Pseudopleuronectes americanus*; Woods Hole.

Vegetative form: Similar to that of *Myxobolus* funduli.

Spore: Hahn writes as follows: Shape and appearance resembles *Myxobolus pfeifferi*. Dimensions: length 14.5μ, breadth 11.9μ, polar capsules 6μ by 3.7μ.

MYXOBOLUS CAPSULATUS Davis

[Fig. 478]

1917	*Myxobolus capsulatus*	Davis	1917 : 237

Habitat: Visceral connective tissues of *Cyprinodon variegatus*; Beaufort.

Vegetative form: Irregular form. In the state of diffuse infiltration. Polysporous.

Spore: Pyriform, flattened. Polar capsules large and pyriform, filling almost entire cavity of the spore. Sporoplasm relatively small. Iodinophilous vacuole visible in living spore. Dimensions: length 16μ, breadth 10 to 11μ, polar capsules 11μ by 4μ, length of polar filament 84μ.

MYXOBOLUS NODULARIS Southwell et Prashad
[Figs. 479 and 480]

1918	*Myxobolus nodularis*	Southwell and Prashad	1918 : 347

Habitat: In the muscles of *Rasbora daniconius* occurring in two fish on the sides, and in another as a globular cyst near the anus; Mirpur, Dacca (June). Type specimens, numbered P 52/1.

Vegetative form: Cysts rounded or slightly elongated, varying in length 3.5 to 3.8mm. and 2.3 to 2.8mm. in width. Creamy yellow in color, in one case appearing blackish owing to the large number of black granules scattered in its surface.

Spore: Ovoidal. Sutural ridge very wide (about 1/5 thickness of the spore). Two polar capsules of equal size, which show coiled polar filaments clearly. Dimensions: length 9μ, breadth 7.2μ, length of polar capsule 3.4μ, that of polar filament 18.3μ.

MYXOBOLUS HYLAE Johnston et Bancroft
[Figs. 591 to 593]

1888		Fletcher	1888 : 337
1890		Haswell	1890 : 661
1909	*Myxobolus* sp.	Johnston	1909 : 29
1910	*Myxobolus* sp.	Cleland and Johnston	1910 : 25
1918	*Myxobolus hylae*	Johnston and Bancroft	1918 : 171-175

Habitat: In the testes, vasa efferentia and oviducts of *Hyla aurea*; Sidney, Australia (April, other months not mentioned). Fletcher observed the parasites also in the urinary bladder of both sexes, which fact was not confirmed by Johnston and Bancroft on account of the scarcity of the material. The latter authors could not infect *Hyla caerulea* by feeding infected testes or the cysts, giving the conclusion that the parasite is specific to *H. aurea*. The male is more often attacked by the parasite than the female. The infected animal appeared sickly and emaciated. As to the infection in kidneys, they write as follows: In one male specimen both testes and both kidneys were affected, and the upper parts of the ureters adjacent to the kidneys were swollen and milky in appearance. In another, in addition to the testes, the adjacent kidney and mesentery were attacked. No spores have yet been detected by them in sections of the kidney tubules.

Vegetative form: Johnston and Bancroft describe as follows:

Cysts: in male, either imbedded in the tissue or may project freely into the coelom of the testes; in female, lying between the layers of the wall, being projected into the lumen of the oviduct. Size from those of microscopic dimensions up to 2 to 3mm. in diameter. In sections, the protoplasm is differentiated into two regions. The outer layer (ectoplasm) surrounds the body as a thin, light-staining region, while the endoplasm being denser and of more or less granular structure filled with spores especially in the central portion.

Spore: Johnston and Bancroft describe as follows:

Form somewhat variable, caused by the reduction in length. Oval, egg-shaped or nearly circular in front view. Sutural ridge slightly thickened. Two pyriform polar capsules are located at the anterior end. Sporoplasm with an iodinophilous vacuole (2μ in diameter), shows usually two distinct nuclei, rarely but one. Dimensions: length variable, diameter of circular form 7 to 8μ, breadth 8 to 10μ, thickness about 6μ, thickness of shell 1μ, polar capsules 4 to 5μ by 2μ, length of polar filament 90 to 98μ (acids or alkalies).

MYXOBOLUS AUREATUS Ward

[Figs. 643 to 649]

1919	*Myxobolus aureatus*	Ward	1919 : 49

Habitat: Between the ectodermal layers of the fin membrane of *Notropis anogenus*; Put-in-Bay, Lake Erie (August). Out of thirty fish, two to three cm. in length, seven were found to be infected. The infected fish were not inferior in size or vigor to others of the same species. The most heavily infected one was the most vigorous of all. The number of cysts in the individual fish, varied from one to forty, being confined in the fin. The cysts are always separated from each other, tho in a few instances they were apparently connected.

Vegetative form: The parasite forms cysts between the ectodermal layers of the fin membrane. The cyst is a smooth margined ellipsoid, measuring from 1 to 1.6 mm. in layer diameter and from 0.8 to 1.2 mm. along its transverse axis. The opaque cyst is of a clear orange yellowish color. This gilt color is contained in the cyst wall, fading away in alcohol and formol. The chromatophores of the skin of the host are distinctly more abundant on the cyst than in other parts of the skin, and the older the cyst the more abundant the chromatophores. The wall of the cyst is noticeably tough and thick. In section, the protoplasm shows a poor differentiation into ectoplasm and endoplasm. The former granular and reticular, covers the entire surface as a thin layer, while the latter is highly vacuolated, containing only mature spores. Polysporous.

Spore: Ovoid; slightly pointed anterior and rounded posterior ends in front view; slightly compressed in lateral view. Sutural ridge distinct. The shell is of moderate thickness, and bears a flange at the posterior half in some spores. Two pyriform polar capsules, frequently of slightly different dimensions, are at the anterior part of the spore. No intercapsular appendix is present. When the spore is allowed to stand for 24 hours or more in water, the polar filaments are extruded. The binucleated finely granular sporoplasm shows an iodinophilous vacuole. Dimensions: length 12.4 to 13.5μ, breadth 6.5 to 7.5μ, thickness 5μ, length of polar capsule 6 to 7μ (rarely 7.5μ), length of polar filament about 20 to 26μ, diameter of iodinophilous vacuole about 2μ.

MYXOBOLUS MIYAIRII nov. spec.
[Fig. 481]

1909 *Myxobolus* sp. Miyairi 1909 : 130, 131–132

Habitat: Intestinal wall of *Parasilurus asotus* L.; Fukuoka ? (Nippon)

Vegetative form: Cysts. Size rather small up to 0.5mm. Full-grown spores as well as those in developmental stages fill the central portion of cysts, while numerous nuclei are chiefly found along the periphery of endplasm.

Spore: Elongated elliptic. Two polar capsules of nearly same size. Sporoplasm with a comparatively large iodinophilous vacuole. Dimensions: length 13 to 14.5μ, breadth 6 to 7μ, length of polar capsules 4.5μ, length of polar filament 30 to 35μ.

Remarks. As the descriptions show the form and structure are distinguishable from other species, the writer establishes the present species.

MYXOBOLUS KOI nov. spec.
[Figs. 482 to 485]

Habitat: In the connective tissue of the gill filament of *Cyprinus carpio* L.; Tokio (April). One fish was found infected in a slight degree.

Vegetative form: Cysts small and spherical; white in color. Size up to 230μ in largest diameter. The seat similar to *Myxobolus toyamai*. The structure of the cysts, observed in section preparations, is also similar to the above mentioned unicapsular Myxobolus.

Spore: Oval with attenuated anterior and rounded posterior ends in front view; elongated pyriform in side view. Shell comparatively thin. No marking on shell. Sutural ridge fairly well marked. No intercapsular appendix. Two polar capsules are pyriform, large, and of usually equal form and size. Coiled polar filament distinct in vivo. Sporoplasm rather small, finely granular, shows two nuclei in almost all spores. An iodinophilous vacuole is deeply stained by Lugol's solution. Dimensions: 14 to 16μ, breadth 8 to 9μ, thickness 5 to 6μ, polar capsule 8 to 9μ by 2.5 to 3μ, length of polar filament 72μ in average (KOH).

MYXOBOLUS ORBICULATUS nov. spec.
[Figs. 566 to 576]

Habitat: Muscle of myotomes of *Notropis gilberti* J. et M.; Stony Creek, Ill. (November). The fish was kept alive in an aquarium from November

11, 1918, until March 10, 1919, when it was killed, being then nearly dead. The material was examined on March 15. A few isolated spores occurred in the muscle of *Notropis blennius* (Homer Park, Ill., November).

Vegetative form: In and between the muscle bundles of the myotomes. Size variable. Color opaque white under the dissecting microscope. Smallest rounded ameboid forms with a single or numerous nuclei, in the muscle bundle, have the size of from 10μ to 30μ in greatest diameter (Figs. 573 to 575). The largest form observed was 400μ by 120μ. Young forms without any differentiated protoplasm, shows indistinct granular and reticular structure with deeply staining spherical or ring-form chromatinic granules. The number of the nuclei increases with the growth of the body. Larger form (Fig. 576), spindle shape, circular in cross-section, lies with its long axis parallel to the muscle fibres. The protoplasm vacuolated, contained mostly mature spores. Spores were also found in the state of diffuse infiltration. Polysporous.

Spore: Form somewhat variable. Typical form almost circular, slightly pointed at the anterior end (Fig. 566) in front view; spindle shaped in profile (Figs. 569 and 570). Sutural ridge marked. Shell uniformly thick, usually exhibiting four triangular folds on the surface along the posterior margin (Figs. 566, 568 and 571). No intercapsular appendix. Two pyriform polar capsules are, as a rule, of the same size and form. Frequent occurrence of the inequality of the polar capsules together with abnormalities in the form of the spore, were noticed especially among comparatively young spores. The granular sporoplasm, shows two spherical nuclei when stained. The iodinophilous vacuole, spherical and 2μ in average diameter, is deeply stained with Lugol's solution. Dimensions of unstained preserved spores: length and breadth 9 to 10μ, thickness 6.5 to 7μ, polar capsule 6 to 7.5μ by 2.5 to 3μ.

MYXOBOLUS DISCREPANS nov. spec.

[Figs. 597 to 601]

Habitat: Branchial lamellae of *Carpiodes difformis*; Salt Fork, Urbana, U.S.A. (May). One fish caught, died (soon after the capture) two hours before being fixed. Length 8.5cm.

Vegetative form: The parasites formed numerous cysts on the branchial lamellae. Cysts slightly yellowish white and mostly rounded or elongated along the lamella, occur in groups, often occupying the entire lamella. Infection was fairly heavy. Every gill arch harbored ten to twenty cysts mostly on the outer surface. Size of the cyst varies, small rounded one 500μ in diameter up to elongated forms 2mm. by 0.5mm., the majority being from 0.5 to 1mm. in diameter. The cyst is surrounded by a thin connective tissue layer of the host. The protoplasm shows little differentiation. The ectoplasm is a rather narrow zone around the entire body and the endoplasm is filled with various nuclei, several stages of developing pansporoblasts, and mature spores. Each pansporoblast produces two spores. Polysporous.

Spore: Approximately circular with broad anterior and more or less narrower posterior end in front view; broadly fusiform in profile. Shell uniformly thin with 5 to 6 markings on the posterior margin. Two polar capsules broadly oval and convergent, fill the anterior half of the spore. A small triangular intercapsular appendix presents. Coiled polar filament is fairly visible in vivo. The spores from the cysts which were fixed with alcohol-acetic and preserved in 95 per cent alcohol, showed the extrusion of the polar filament under the influence of potassium hydrate solution (35 per cent) even after a considerable lehgth of time as is shown in the following:

Material fixed on May 29.
June 2; Extrusion took place in almost all spores.
June 10; Extrusion took place in almost all spores.
June 26; Extrusion took place in almost all spores.
July 28; Extrusion took place in almost all spores.
August 29; Extrusion took place in numerous spores.
September 29; Extrusion took place in about 70 per cent of the spores, some filaments being rather short, and not fully extended.
October 20; Extrusion took place in about 50 per cent of the spores, most filaments being short, and not fully extended.

Sporoplasm coarsely granular shows clearly two ring-form nuclei in fresh preparations. Dimensions of preserved spores: length 11.4 to 13.5μ, breadth 9.5 to 11μ, thickness 8.5 to 9.5μ, polar capsule 5.5 to 6μ by 3.5 to 4μ, length of polar filament 50 to 55μ.

Remarks: The present species differs from the hitherto known species. *Myxobolus lintoni* (page 138) and *Myxobolus orbiculatus* (page 155) which are the nearest to the present form, differ from *Myxobolus discrepans* in the host, organ of infection, vegetative form and form and structure of the spore.

MYXOBOLUS MESENTERICUS nov. spec.

[Figs. 628 to 631]

Habitat: In the mesentery, liver, spleen and wall of stomach, pyloric coecum, intestine, and gall-bladder of *Lepomis cyanellus*; Crystal Lake, Urbana, Ill. (June and July). Out of thirty-six host fish, 10 cm. in average length, seven were found to be infected. In every case, except one, the mesentery was the main seat of infection, harboring conspicuous cysts. The number of cysts found in the host body varied from three to seven. The infected fish did not exhibit any recognizable pathological changes. Other species of fish caught at the same time, were free from the infection.

Vegetative form: The cysts are mostly spherical in form, and are covered by a tough resistant envelope composed of the connective tissue of the host. They are uniformly white in color, and have the variable dimensions of from 0.5 to 1.5mm. in diameter. In section, the protoplasm shows a coarsely reticulated structure without distinct differentiation. In all cysts of various sizes fully mature spores were only observed. The spore formation could not be worked out. Polysporous.

Spore: Broadly oval with a slightly truncated anterior end in front view (Fig. 628), lenticular in side or end view (Fig. 629). No intercapsular appendix is seen. The shell is rather thick, and shows about eight folds on the sutural edge, two of which located laterally being more conspicuous than others. The sutural ridge is rather fine. Two convergent polar capsules equal in size occupy the anterior half of the spore. The coiled polar filament becomes more distinctly visible with the addition of Lugol's solution, altho it is faintly observable in fresh state. Fresh spores extruded their polar filaments under the action of potassium hydrate solution. In some spores, the extruded filaments cross each other near the foramina. The preserved spores showed no extrusion of the filament as in the last species. The sporoplasm is extremely finely granulated. The iodinophilous vacuole is comparatively large. When stained, the spore shows two nuclei in the sporoplasm. Dimensions of fresh material: length 10 to 11.5μ, breadth 8.5 to 9.5μ, thickness 6.5μ, polar capsule 4.75μ by 1.5 to 2μ, length of polar filament 32 to 40μ. Average dimensions of unstained preserved spores: length 9.5μ, breadth 8μ, polar capsule 4.75 μ by 2μ.

Remarks: The habitat and the structure of the spores, lead the writer to record the species as a new species.

Genus HENNEGUYA Thélohan

1892	*Henneguya*	Thélohan	1892 : 167, 176
1895	*Henneguya*	Thélohan	1895 : 352

The characters of the genus are described on page 59.

Type species: *Henneguya psorospermica* Thélohan.

HENNEGUYA PSOROSPERMICA Thélohan
[Figs. 486, 487 and 496]

1895	*Henneguya psorospermica*	Thélohan	1895 : 353
1896	*Myxobolus psorospermica* s. str.	Cohn	1896 : 261
1899	*Henneguya psorospermica typica*	Labbé	1899 : 101
1905	*Henneguya psorospermica*	Nufer	1905 : 77, 185
1910	*Henneguya psorospermica*	Wegener	1910 : 81–82
1911	*Henneguya psorospermica typica*	Auerbach	1911 : 5, etc.

Habitat: Branchiae of *Esox lucius* L. and *Perca fluviatilis;* France, Frisches and Kurisches Haff, Pregel, Masurische Seen (all the year round, but rarer in Winter) Switzerland.

Vegetative form: Thélohan's observations on the structure of the cyst, are as follows: The surface of the cyst is covered by a layer, homogeneous, refringent and deeply stained, with which the cyst comes in direct contact with the surrounding epithelial cells of the host. Inside of this layer, there is a "pseudoectoplasmic" zone, in which the protoplasm is dense at places, forming radiate irregular striations, enclosing numerous irregular masses which are composed of apparently the same substance that forms the external layer. Toward the central portion of the cyst, there are masses of spores (Fig. 496).

Cohn's descriptions are as follows: The purely white cyst is elliptical; length 1.15mm. and breadth 0.85mm. The seat is under the epidermis. It is surrounded by the host tissue with small, elongated and scattered nuclei. The outer layer of the cyst is a thin membraneous protoplasm.

Wegener writes as follows: The white cysts are round or elliptical, usually on the upper end of the branchial lamella. Size of larger cysts, 1.5 to 2mm. long and 1.1 to 1.5mm. wide.

Spore: Elongated; anterior part fusiform and anterior end blunt. Polar capsules elongated and parallel to each other. Coiled polar filament visible in fresh conditions. Shell unstriated. Dimensions: total length 40μ in average, largest breadth 7μ, length of polar capsule 7 to 8μ.

Cohn's form is described by him as follows: Spore narrow with blunt anterior end. Sporoplasm with 6 horns (no figure to explain this expression!). When kept in water, sporoplasm takes round form and becomes highly refractive. Dimensions: length 29 to 38μ, length between the tip and the posterior margin of the cavity (15 to 20μ) 18μ, breadth 9 to 10μ, polar capsule (8 to 11μ) 9μ by 2μ, length of "starren Fäden" 14μ, length of tail 14 to 18μ.

Wegener's form is as follows: total length 35 to 38μ, breadth 7 to 8μ, length of the spore cavity 15μ, length of tail 15 to 20μ, polar capsule 8μ by 2 to 3μ.

HENNEGUYA TEXTA (Cohn) Labbé

1895	*Myxobolus textus*	Cohn	1895 : 38–39
1899	*Henneguya psorospermica texta*	Labbé	1899 : 101
1910	*Henneguya texta*	Wegener	1910 : 82–83

Habitat: Branchiae of *Perca fluviatilis* L.; Pregel, Frisches and Kurisches Haff (all the year round).

Vegetative form: Cohn observed as follows: Cyst distinctly elliptical. Length 0.75mm., breadth 0.375mm. The cysts surrounded by a thick layer of the host tissue. In the peripheral portion of the cyst, the protoplasm exhibits a network-like structure which forms a fibrous structure further inside, crossing the cyst at right angles to the long axis of the cyst.

Wegener writes as follows: The white cysts are elongated, 1.2 to 1.8mm. long and 0.5 to 0.7mm. wide.

Spore: Cohn mentions dimensions exactly the same as those of *Henneguya psorospermica* and can not distinguish the two species by the spore.

Wegener gives the following dimensions: length 30 to 40μ, breadth 7 to 8μ, length of the cavity of spore 15 to 18μ, length of tail 15 to 25μ, polar capsule 8μ by 2 to 3μ.

HENNEGUYA MINUTA (Cohn) Labbé

[Figs. 488 and 489]

1895	*Myxobolus minutus*	Cohn	1895 : 39–40
1899	*Henneguya psorospermica minuta*	Labbé	1899 : 102

Habitat: Branchiae of *Perca fluviatilis* L.; Frisches Haff, Lesina.

Vegetative form: Cohn's description is as follows: Cysts oval and small, difficult to distinguish them from those of *Henneguya psorospermica.* Size, 130μ by 115μ. The parasite was met only once. But the number of the cysts was far greater than that of *Henneguya psorospermica*, often 5 to 6 on one lamella, reaching up to 200 cysts on a single gillarch.

Spore: Cohn gives the following dimensions: total length (28 to 45μ) about 36μ, length from the tip to the end of cavity (20 to 28μ) about 26μ, breadth 10 to 11μ, thickness 8μ, polar capsule 11 to 14μ by 2 to 3μ, length of polar filament 42 to 45μ, length of tail (8 to 17μ) 12μ. Cohn gives a figure (Fig. 489) of a spore with two vacuoles(?).

HENNEGUYA OVIPERDA (Cohn) Labbé

[Figs. 490 and 491]

1892		Weltner	1892 : 28–36
1895	*Myxobolus oviperdus*	Cohn	1895 : 40–41
1899	*Henneguya psorospermica oviperda*	Labbé	1899 : 102
1904	*Henneguya psorospermica oviperda*	Fuhrmann	1904 : 469–471
1911	*Henneguya psorospermica oviperda*	Auerbach	1911 : 5-22
1911	*Henneguya psorospermica oviperda*	Nemeczek	1911 : 146

Habitat: Ovary of *Esox lucius* L.; Switzerland, Berlin, Frisches Haff (all the year round), Upsala (May), Austria (December).

Vegetative form: Cohn writes as follows: No real cyst exists. The parasite occupies the ovum.

Auerbach, however, mentions the presence of cysts in the connective tissue and follicle epithelium of the ovary. Dimensions, 1mm. up to 5 or 6mm. in diameter.

Spore: Cohn states the form and dimensions are very much similar to those of *H. psorospermica*.

HENNEGUYA LOBOSA (Cohn) Labbé
[Figs. 492 and 493]

1895	*Myxobolus lobosus*	Cohn	1895 : 42
1899	*Henneguya psorospermica lobosa*	Labbé	1899 : 102
1910	*Henneguya*(?) *lobosa*	Wegener	1910 : 83
1911	*Henneguya*(?) *lobosa*	Auerbach	1911 : 22–25

Habitat: Branchiae of *Esox lucius* L.; Frisches Haff, Pregel, Karlsruhe.

Vegetative form: Cysts irregular in shape, size up to 2.5mm.

Wegener noticed that the cyst resembles that of *Myxosoma dujardini* with the dimensions of 2.2 to 2.8mm. by 1 to 1.1mm.

Spore: Cohn gives the dimensions as follows: total length 30 to 40μ, length from the tip to the posterior margin of cavity 11.5 to 15μ, breadth 5 to 6.5μ, polar capsules 6.5 to 8μ by 2 to 2.5μ, length of tail 22 to 28μ.

Wegener's form: oval; length 35 to 40μ, breadth 5μ, polar capsule 6 to 7μ by 2.5 to 3μ, length of the cavity of spore 13 to 15μ, length of tail 20 to 25μ, the iodinophilous vacuole could not be detected.

Auerbach gave the following dimensions: total length 30μ, breadth 4 to 6μ, length of polar capsule 6μ, length of polar filament 48 to 54μ.

Remarks: Wegener and Auerbach did not observe the iodinophilous vacuole.

HENNEGUYA PERI-INTESTINALIS Cépède

1906	*Henneguya psorospermica peri-intestinalis*	Cépède	1906 : 67
1907	*Henneguya psorospermica peri-intestinalis*	Cépède	1907 : 137
1912	*Henneguya psorospermica peri-intestinalis*	Parisi	1912 : 295

Habitat: Intestine of *Esox lucius* L.; Lac du Bourget, Pavia. (June).

Vegetative form: Cysts.

Spore: Cépède mentions that it resembles that of *Henneguya psorospermica*.

HENNEGUYA MEDIA Thélohan
[Figs. 494 and 495]

1890		Thélohan	1890 : 198–200
1892	*Henneguya media*	Thélohan	1892 : 177
1894	*Myxobolus medius*	Gurley	1894 : 248
1895	*Henneguya media*	Thélohan	1895 : 353
1898	*Henneguya media*	Doflein	1898 : 342

Habitat: Renal tubules of kidney and ovary of *Gasterosteus aculeatus* and *G. pungitius* L.; France. Mixed infection with *Sphaerospora elegans*.

Vegetative form: Rounded or elongated. In larger individuals, clear differentiation of protoplasm. Monosporous (?) and polysporous.

Spore: Fusiform. Shell striated. A vacuole in sporoplasm. Dimensions: length 20 to 24μ, breadth 5 to 6μ, polar capsules 4 to 5μ. Tail short.

HENNEGUYA BREVIS Thélohan

1854		Lieberkühn	1854 : 357
1892	*Henneguya brevis*	Thélohan	1892 : 177
1895	*Henneguya brevis*	Thélohan	1895 : 354

Habitat: Similar to *H. media* Thélohan.

Vegetative form: Undescribed.

Spore: Fusiform with short tail. Dimensions: length 14 to 15μ, breadth 5 to 6μ, polar capsules 1.4 to 5μ, tail 4 to 5μ long.

HENNEGUYA SCHIZURA (Gurley) Labbé
[Figs. 497 to 499]

1841		Müller	1841 : 477–478
1893	*Myxobolus schizurus*	Gurley	1893 : 417
1894	*Myxobolus schizurus*	Gurley	1894 : 255
1899	*Henneguya schizura*	Labbé	1899 : 102–103

Habitat: In cellular tissue of the eye muscles, in that of the sclerotic, and in that between the sclerotic and choroid of *Esox lucius* L.; Germany, U. S. A.

Vegetative form: Cysts white; membrane delicate; 0.44 to 1.09mm. in diameter.

Spore: Oval. Dimensions: length 12μ, breadth 6μ, thickness one-half the breadth, tail 3 to 4 times length of the body.

HENNEGUYA CREPLINI (Gurley) Labbé
[Figs. 500 to 503]

1842		Creplin	1842 : 61–63
1894	*Myxobolus creplini*	Gurley	1894 : 248–249
1899	*Henneguya creplini*	Labbé	1899 : 103
1910	*Henneguya creplini*	Wegener	1910 : 84

Habitat: Branchiae of *Acerina cernua* L.; Pregel (March), Frisches and Kurisches Haff.

Vegetative form: Wegener describes as follows: Cysts, usually elongated oval and are located at the end of branchial lamella. Color white. Size 1 to 1.1mm. by 0.5mm. During winter, the cyst has only pansporoblasts, but no fully grown spores.

Spore: Creplin writes as follows: Elongated elliptical. Length 1/120''', breadth 1/360''', tail about as long as or a little longer than the body.

Wegener's form: elongated spindle shape; length 20μ, breadth 8 to 9μ, polar capsule 8μ by 2 to 3μ (parallel to each other).

Remarks: Wegener thinks that the present species and *Henneguya acerinae* Schröder, are one and the same species, and that the differences between the dimensions are due to the miscalculation of measurement in lines given by Creplin on the part of Gurley and Labbé.

HENNEGUYA LINEARIS (Gurley) Labbé
[Fig. 504]

1841		Müller	1841 : 489
1893	*Myxobolus linearis* (part)	Gurley	1893 : 417
1894	*Myxobolus linearis*	Gurley	1894 : 255
1899	*Henneguya linearis*	Labbé	1899 : 103

Habitat: Membrane lining branchial cavity of *Pimelodus sebae* Cuv. et Val., branchiae of *Platystoma fasciatum* L.; South American rivers.

Vegetative form: Not described.

Spore: Very narrow. Length 3 to 4 times breadth.

HENNEGUYA GURLEYI Kudo
[Fig. 505]

1893	*Myxobolus linearis* (part)	Gurley	1893 : 417
1894	*Myxobolus* cf. *linearis*	Gurley	1894 : 253–254
1899	*Henneguya linearis* var.	Labbé	1899 : 103

Habitat: Base of spines of the second dorsal fin of *Ameiurus melas* Raf.; Iowa (Storm Lake) (August).

Vegetative form: Spherical cysts, 1mm. in diameter.

Spore: Lanceolate. Dimensions: length of the body 19μ, width 5 to 6μ, thickness about 3μ.

Remarks: The species is most probably different from *Henneguya linearis* judging from the difference in the form and structure of spores, the seat of infection, and host species. Hence, it is recorded here as an independent species.

HENNEGUYA STRONGYLURA (Gurley) Labbé
[Fig. 506]

1841		Müller	1841 : 480
1894	*Myxobolus strongylurus*	Gurley	1894 : 249
1899	*Henneguya strongylura*	Labbé	1899 : 103

Habitat: Skin of cephalic region of *Synodontis schall* Bl. Schn.; Nile.

Vegetative form: Cysts over 2.18mm. in diameter.

Spore: Dimensions: length of the body 9μ, breadth 5.4μ. Tail always undivided. Two polar capsules of equal size.

HENNEGUYA MONURA (Gurley) Labbé
[Fig. 507]

1880		Ryder	1880 : 211–212
1893	*Myxobolus monurus*	Gurley	1893 : 416
1894	*Myxobolus monurus*	Gurley	1894 : 249–250
1899	*Henneguya monura*	Labbé	1899 : 103

Habitat: Subcutaneous intermuscular tissue of *Aphredoderus sayanus* Gill.; New Jersey (Woodbury).

Vegetative form: Cysts, lenticular, large, white, opaque and numerous (20). Membrane thin.

Spore: Lenticular or slightly obovate. Tail 2 to 3 times longer than the body.

HENNEGUYA KOLESNIKOVI (Gurley) Labbé
[Fig. 508]

1886		Kolesnikov	1886 : 242–248
1894	*Myxobolus kolesnikovi*	Gurley	1894 : 256–257
1898	*Myxobolus bicaudatus* (part)	Zschokke	1898 : 602–604, 646–655, 699–703
1899	*Henneguya kolesnikovi*	Labbé	1899 : 103–104

Habitat: Interstitial connective tissue of the thoracic and intercostal muscles of *Coregonus lavaretus* L.; Russia.

Vegetative form: Cysts numerous (80), spherical or oval; length 10 to 30mm., breadth 7 to 20mm.

Spore: Oval with a pointed anterior end. Tail three times longer than the body.

Remarks: Zschokke thinks the present species is identical with ***Henneguya zschokkei.*** But the evidence is not clear enough to bring one to agree with him due to the incomplete description of the present species.

HENNEGUYA MACRURA (Gurley) Thélohan
[Figs. 509 to 512]

1893		Evermann	1893 : 76
1894	*Myxobolus macrurus*	Gurley	1894 : 250–253
1895	*Henneguya macrura*	Thélohan	1895 : 354

Habitat: Subcutaneous connective tissue of head of *Hybognathus nuchalis* Ag.; Neches River, Texas (November, temperature of water 9°.4C.) Of frequent occurrence.

Vegetative form: Cysts, elongated 6mm. by 2mm. or less.

Spore: Rounded oblong. Dimensions: length 10 to 11μ, breadth 6 to 8μ, thickness 4μ. Shell-valves unequally convex. Tail 30 to 40μ.

HENNEGUYA ZSCHOKKEI (Gurley) Doflein

[Fig. 513]

1884		Zschokke	1884 : 234–235
1894	*Myxobolus* (?) *zschokkei*	Gurley	1894 : 244
1898	*Myxobolus bicaudatus* (part)	Zschokke	1898 : 602–607, 646–655, 699–703
1898	*Myxobolus bicaudatus*	Zschokke	1898a : 213–214
1901	*Henneguya zschokkei*	Doflein	1901 : 202
1904	*Henneguya zschokkei*	Hofer	1904 : 56
1905	*Henneguya zschokkei*	Nufer	1905 : 77, 185

Habitat: Subcutaneous and superficial intermuscular tissue of *Coregonus fera, C. schinzii* Fatio, *C. hiemalis* Jur. and muscular tissue and branchia of *C. wartmanni nobilis* and *C. exiguus albellus*; Neuchâteler See, Zurich See, Genfer-see, Thuner-see, Vierwaldstätter-see.

Vegetative form: Zschokke writes as follows: Cysts rounded or oval surrounded by a compact membrane with many nuclei. The largest 32mm. by 16mm. Protoplasm granular. Polysporous.

Spore: Rounded oval in front view; broad elliptical in side view. Anterior end rounded; posterior end tapering, forming tail. Sutural ridge distinct. Tail is either bifurcated along the entire length or a single form, no intermediate form being observed. Dimensions: total length 55μ, length of the body 10μ, breadth 7μ, length of tail 4 to 5 times the length of the spore-body, length of polar filament 6 to 10 times that of the body of the spore.

Remarks: Zschokke thinks that *Henneguya kolesnikovi, H. zschokkei* and *H.* sp. Gurley are one and the same species, for which he proposed the name *Myxobolus bicaudatus*.

HENNEGUYA sp. (Gurley) Labbé

[Fig. 514]

1886		Benecke	1886 : 211
1894	*Myxobolus* sp. inc.	Gurley	1894 : 244
1899	*Henneguya* sp.	Labbé	1899 : 104
1904	*Henneguya* sp.	Hofer	1904 : 51

Habitat: Integument (?) of *Leuciscus rutilus* L. The parasites formed boil-like enlargement in the skin.

Vegetative form: Not described.

Spore: Not described.

HENNEGUYA sp. (Gurley) Labbé

1874		Claparède	1874 : 114
1894	*Myxobolus* sp. inc.	Gurley	1894 : 253
1898	*Myxobolus bicaudatus* (part)	Zschokke	1898 : 602–607, 646–655, 699–703
1899	*Henneguya* sp.	Labbé	1899 : 104

Habitat: Branchial-arches of *Coregonus fera*; Genfer-see.

Vegetative form: One cyst, 1mm. in diameter.

Spore: Tail short. Zschokke quotes: length 8 to 10μ.

Remarks: According to Zschokke, this species is identical with *H. zschokkei.*

HENNEGUYA TENUIS Vaney et Conte
[Fig. 515]

1901	*Henneguya tenuis*	Vaney and Conte	1901 : 103–106

Habitat: Connective tissue of alimentary tract of *Acerina cernua* L.; Lyon (February).

Vegetative form: Numerous cysts particularly in the pyloric coecum. Usually spherical. Size: 30 to 150μ in diameter.

Spore: Oval and small. Tail short. Two polar capsules at the anterior end. Sporoplasm with a nucleus, rod-shaped, with somewhat enlarged ends which is located at right angles to the longitudinal axis. Iodinophilous vacuole could not be traced. Dimensions: length 4μ, breadth 2μ.

HENNEGUYA NÜSSLINI Schuberg et Schröder
[Figs. 516 and 517]

1905	*Henneguya nüsslini*	Schuberg and Schröder	1905 : 56–59

Habitat: Subcutaneous connective tissue at the base of dorsal fin of *Trutta fario* L.; Gutach.

Vegetative form: Trophozoites form cysts (2 cysts found). Cysts lenticular, 1.5 to 2mm., surrounded by many concentric layers of fibrous connective tissue. Cysts containing only mature spores.

Spore: Broad oval form, flattened. Anterior end rounded. Tail at the posterior end. Shell somewhat thick, often shows sutural ridge. Tail filaments two. A "dark part" which in side-view is of triangular form, runs into the tail. Sporoplasm, occupying the posterior half of the spore, projects a narrow portion between the polar capsules beyond the middle of the capsules. Sporoplasm, uniformly granular, contains an iodinophilous vacuole and one, sometimes two nuclei connected by nuclear bridge. Polar capsules, pyriform, opening independently. Coiled polar filament observable, coiled 6 to 7 times. Dimensions: length excluding tail 12μ, length with tail 32μ, breadth 8 to 9μ, polar capsules 5μ by 3μ, length of polar filament 4 to 5 times longer than that of spore excluding tail (48 to 60μ).

HENNEGUYA LÉGERI Cépède
[Figs. 518 to 523]

1905	*Henneguya légeri*	Cépède	1905 : 905–913
1906	*Henneguya légeri*	Cépède	1906 : 66
1913	*Henneguya légeri*	Cépède	1913 : 302–305

Habitat: Urinary bladder of *Cobitis barbatula* L.; Isère (January).

Vegetative form: Young trophozoites subcircular, irregularly elliptical or elongated with distinct differentiation of protoplasm into ectoplasm and endoplasm. Plasmotomic multiplication takes place during winter months, when no spore is formed.

Spore: Oval with short tail, mostly bifurcated at the free end. The anterior end is more rounded, occasionally acuminated. Two polar capsules of equal size. Coiled polar filament distinct in vivo. Sporoplasm granular, contains two nuclei and a vacuole. The spore often shrinks in fresh conditions, probably owing to the poorly developed thin valves. Dimensions of spores mounted in balsam: length variable. Examples: Total length 22.5μ, tail 8.5μ; total length 19.5μ, tail 8μ; length of main part 8.5μ, breadth (comparatively constant) 6μ.

HENNEGUYA ACERINAE Schröder
[Figs. 525 and 526]

1906	*Henneguya acerinae*	Schröder	1906 : 186–196
1910	*Henneguya creplini*	Wegener	1910 : 84
1911	*Henneguya acerinae*	Nemeczek	1911 : 155

Habitat: Branchiae of *Acerina cernua* L., *Aspro zingel* Cuv., *Lucioperca lucioperca* L. and *L. sandra* Cuv. (?); Heidelberg (Necker), Apatin, Komitat Baco-Bodrog, Hungary (May).

Vegetative form: Schröder describes as follows: Rounded or spherical cysts in the connective tissue of branchial lamella. Full-grown cysts up to 300μ in diameter. Protoplasm is differentiated into ectoplasm and endoplasm. Ectoplasm shows fine radial striations. Endoplasm granular, contains many nuclei, especially lying in the middle portion. Well developed cyst, containing only spores, is surrounded by a membrane. On the surface of the ectoplasm, numerous edge-like elevations, branched and joining together, were recognized. Polysporous.

Nemeczek observed the largest cyst, spherical and 600μ in diameter.

Spore: Pyriform in front view; flattened. The anterior end is more or less blunt. Shell uniformly thin. Sutural edge slightly enlarged. Sporoplasm finely granular, contains an iodinophilous vacuole and two nuclei. Polar capsules approximated closely, each having an independent opening. Dimensions: length 20 to 22μ, breadth 8 to 9μ, thickness 6 to 7μ, length of tail 50 to 60μ, polar capsules 10μ by 2 to 3μ, length of polar filament 80 to 90μ (water and nitric acid).

Nemeczek's form is as follows:

The tail is bifurcated along its entire length. In one case (May, 1909), however, all the spores had no bifurcated tail, while the polar capsules were of unequal size. Dimensions in fresh state: total length 37.6 to 41.8μ, length, excluding tail 12.6 to 16.8μ, breadth 4.5μ, length of polar capsule 6.3 to 8.4μ, length of polar filament 67μ, length of tail 25μ.

Nemeczek observed two more different (?) forms. One form found in *Lucioperca sandra,* tho the size differs from the dimensions given by Schröder, is thought to be identical with the present species. Another form in the branchiae of *Aspro zingel,* which is also to be one and the same species with the present species has the following dimensions: total length 35μ, length of spore excluding tail 15μ, breadth 5μ, length of polar capsule 6μ, length of tail 20μ.

HENNEGUYA GIGANTEA Nemeczek

[Figs. 527 to 535]

1911	*Henneguya gigantea*	Nemeczek	1911 : 146–154
1914	*Henneguya gigantea*	Georgévitch	1914 : 387–409

Habitat: Branchiae of *Lucioperca sandra* Cuv.; Apatin, Komitat Bacs-Bodrog, Hungary, Petrograd. Nemeczek mentions that the infection takes place only among young fish.

Vegetative form: Cysts numerous and of conspicuous size in the free end of branchial lamella. In average, each gill-arch has about 100 cysts which are of creamy color. Young cysts 400 to 450μ in diameter. They gradually begin to increase the size, from autumn until toward the end of spring, during which period, the contents remaining in the stages of pansporoblasts formation. Older cysts rounded spindle shape with the length of 4 to 7mm. and the breadth of 2 to 3mm. The connective tissue and epithelial cell layers form the cyst membrane. The connective tissue either simply surrounds the parasite or branches in the surface of the parasite, increasing in thickness and forming more or less enclosed chambers of the parasite. The membrane of the cyst which contains mature spores is usually very thin. Throughout the growth of the cyst, "chromatoid body" is seen in the endoplasm, which appears first as a filiform structure, stained deeply with nuclear stain. Later they gather together and form a compact body, situated excentrically. Fine branches from it become directed toward the surface of the body, anastomosing each other so that a network is formed on the surface of the cyst. The latter develops small ovoidal or columnal bodies (1.2μ long and about 1μ wide), which are arranged radially and densely. The number and quantity of these bodies increase in proportion to the number of propagative nuclei and they begin to disappear, first in the central portion, then in the periphery, so that in fully grown cysts (in summer months) these chromatoidal bodies are more rudimentary. Differentiated protoplasm is only recognized in young individuals, in which case ectoplasm is homogeneous and endoplasm reticular. Polysporous.

Spore: Nemeczek gives the following accounts.

Spindle shape, with truncate anterior end and very long thread like tail at the posterior end. The tail seems split into two at about the middle part of its length. Gentian violet stains the tail so intensively that its entire length could easily be made out. Dimensions: total length 87.5 to 110.5μ, length of the body 10.5μ, breadth 5μ, length of tail 77 to 100μ, length of polar capsule 5μ, length of polar filament 70μ (pressure or dessication followed by immersion in water).

Georgévitch's form: length excluding tail 15μ, breadth 6μ, length of tail 75μ, length of polar capsule 6μ, length of polar filament 75μ, diameter of the iodinophilous vacuole 4μ.

Remarks: Nemeczek mentions that from October on, cysts had no spores, only containing propagative cells. The velocity of the development of spores depends upon the temerature of water.

Georgévitch worked out the spore formation of the species and observed that the binucleated sporeplasm emerged from the posterior end of the spore.

HENNEGUYA (?) sp. Nemeczek

[Figs. 536 to 539]

1911	*Henneguya* sp.	Nemeczek	1911 : 157–159

Habitat: Branchiae of *Abramis brama*; Komorn, Komitat Komorn, Hungary (March).

Vegetative form: Cysts in the branchiae.

Spore: Besides normal spores of *Myxobolus rotundus* (page 149), spores of Henneguya type in small number were found. The anterior part of these spores resembles that of the species mentioned above, while the breadth is much smaller (8μ) than the latter. Majority of spores have a thread like tail, 10 to 15μ long, which was often bifurcated. An iodinophilous vacuole was fairly marked.

Remarks: It is placed here as a species of Henneguya by reason of the bifurcate tail.

HENNEGUYA GASTEROSTEI Parisi

[Figs. 540 to 543]

1912	*Henneguya gasterostei*	Parisi	1912 : 296–297

Habitat: Kidney of *Gasterosteus aculeatus* L.; Lago di Garda (February).

Vegetative form: Rounded or oval, usually with two, but rarely with four spores. Ectoplasm thin and hyaline. Endoplasm contains numerous granules, most probably of fatty nature and decreasing in number as spores grow. Free full-grown spores were seen abundantly in the connective tissue of renal tubules, glomeruli, etc. Disporous and polysporous.

Spore: Oval with slightly attenuated anterior end; posterior end tapering into tails, which end in one point or bifurcated; asymmetrical in shape, one valve is more curved than the other. This asymmetry of the shell-valves in profile enables the present species to be distinguished from other species. Shell striated longitudinally. Two polar capsules pyriform and well developed, reaching to the middle of the spore. Sporoplasm with a round iodinophilous vacuole. Dimensions: total length 38 to 48μ, length of the cavity of the spore 15μ, breadth 6 to 7.5μ, polar capsules 7.5 to 9μ by 3 to 3.5μ, length of polar filament 50μ.

HENNEGUYA NEAPOLITANA Parisi
[Figs. 544 and 545]

1912	*Henneguya neapolitana*	Parisi	1912 : 297–298

Habitat: Connective tissue of the renal tubule of kidney of *Box salpa* C. et V.; Napoli (August).

Vegetative form: Small cyst (40 to 50μ in diameter) surrounded by thin membrane, containing a number of spores, numerous pigment granules and coarse yellowish globules.

Spore: Oval, slightly flattened. Anterior end rounded when seen from the front, but attenuated in profile. Shell tapering into a long fine tail posteriorly. The fine distal portion of the tail wraps around the thicker part. Two polar capsules, pyriform, occupying the anterior half of the cavity of the spore, cross each other when seen from the front. Sporoplasm finely granular with two nuclei, the iodinophilous vacuole being hardly visible. Dimensions: total length 50 to 60μ, length of the cavity of spore 8.5 to 9.5μ, breadth 8.5 to 9.5μ, internal breadth 6.3 to 7μ, thickness 8μ, polar capsules 4.7 to 5.5μ by 3μ.

HENNEGUYA WISCONSINENSIS Mavor et Strasser
[Figs. 558 and 559]

1916	*Henneguya wisconsinensis*	Mavor et Strasser	1916 : 676–682

Habitat: Urinary bladder of *Perca flavescens*; Lake Mendota, Wisconsin (April).

Vegetative form: Trophozoites are usually elongated and have the general form and shape of a limax ameba. It may reach a size of 300μ by 70μ. Clear differentiation of ectoplasm and endoplasm. Pseudopodia lobose. Two spores are formed in each pansporoblast. Polysporous.

Spore: Ovoid, bilaterally symmetrical, and have a bifurcated caudal process. Two polar capsules at anterior end. Coiled polar filament visible *in vivo* (5 windings). Dimensions: length excluding tail 11.5μ, breadth 7μ, tail 9.6μ, polar capsules 3.5μ by 2.5μ, length of filament 33μ.

HENNEGUYA BRACHYURA Ward

[Figs. 650 to 653]

1919	*Henneguya brachyura*	Ward	1919 : 57

Habitat: In the cartilageous fin ray of the caudal fin of *Notropis anogenus*; Put-in-Bay, Lake Erie (August). The species was found encysted in the same fish which was heavily infected by *Myxobolus aureatus.*

Vegetative form: Cysts rounded with slightly irregular contour imbedded in the fin ray. The size varies from 160μ in diameter up to 360μ by 240μ. No particular cyst membrane could be recognized. The differentiation of the protoplasm into ectoplasm and endoplasm is distinct. The ectoplasm covering the entire surface of the parasite as a layer 4 to 6μ thick, shows structure of a very finely granular nature. The endoplasm coarsely alveolar, is filled with mature spores in the central portion, while numerous nuclei and young spores in various developmental stages are present at the peripheral portion. Polysporous.

Spore: Rounded oval in front view; spindle shape with symmetrically built valves in profile. Shell rather thick. Sutural ridge fairly well marked; sutural edge exhibiting a variable number of folds (8 to 10). Two pyriform polar capsules are usually of the same size and form. The tail is a single process, usually more or less bent or irregularly curved, very rarely being straight. In general, it is sinuous with two or three shallow curves and is rather short, tapering gradually to a point. In young spores which are less deeply stained by any stain, various developmental stages of the tail are reasily recognized. Giemsa solution stains the shell proper in clear blue, while the tail takes on a beautiful pink color, a distinct difference in affinity for dyes between the material in the tail and the shell. It seems probable that the tail of this type is entirely different in its development from that of the ordinary bifurcated type. Dimensions in section: length 10 to 11.5μ, breadth 8 to 8.75μ, thickness 4 to 5μ, polar capsules 3 to 4μ by 2μ, length of the tail up to 17μ.

HENNEGUYA SALMINICOLA Ward

[Figs. 654 to 656]

1914	?*Henneguya zschokkei*	Zschokke and Heitz	1914 : 200–201
1919	*Henneguya salminicola*	Ward	1919 : 59

Habitat: In the sub-dermal tissue of *Onchorhynchus keta* and *O. kisutch* (Zschokke and Heitz, Kamtschatka) and in the connective tissue in body muscles of *Oncorhynchus keta,* Stickeen River, Alaska (Ward, September). The last named author undertook a careful examination of a part of the infected tissue preserved in formol. The species forms conspicuous cysts in the muscle from the sub-peritoneal to the sub-dermal connective tissue, tho all are sub-peritoneal in position.

Vegetative form: Ward describes as follows: The whitish opaque cysts are pyriform, and fairly uniform in size (3 to 6mm. in diameter). The cyst is covered by numerous layers of connective tissue which form a tough membrane around the parasite. The cyst contains young spores in various stages of development, which showed that two spores are formed in one pansporoblast, and mature spores thickly massed together in the central area. Polysporous.

Spore: Oval with rounded anterior and more or less attenuated posterior ends; elliptical in profile with attenuated anterior end. Shell smooth. Sutural edge exhibits folds variable in number (usually 6 to 7). Tail double, composed of two fine and equal halves which are the prolongation of the shell valves. The processes usually run roughly parallel to each other. Two pyriform polar capsules are of slightly different dimensions. Coiled polar filament is indistinct in preserved unstained specimens. Sporoplasm finely granular, shows a large iodinophilous vacuole. Dimensions of stained and mounted spores: total length 47μ (42.75 to 52.44μ), length of the main part 12μ (11.97 to 14.25μ), breadth 8μ (7.12 to 8.43μ), thickness 4.78μ, length of tail 35μ (30.78 to 38.19μ), polar capsule 3.70 to 4.55μ by 1.59 to 2.85μ.

Remarks: Zschokke and Heitz (1914) observed a species from Kamtschatka, which they thought to be identical with *Henneguya zschokkei* (page 165). The writer is inclined to think that the species is identical with the species just described from Alaska.

HENNEGUYA MIYAIRII nov. spec.

[Fig. 524]

1909 *Henneguya* sp. Miyairi 1909 : 127–129

Habitat: Subcutaneous tissue of head of *Carassius auratus* L.; Fukuoka (Nippon).

Vegetative form: Trophozoites form cysts and are also found in the condition of diffuse infiltration around the cysts. Cyst-membrane fibrous and thin. Ectoplasm and endoplasm fairly well differentiated, though the border line is not sharply marked. At the periphery of endoplasm, pansporoblasts with 7 to 12 nuclei are present (Two spores are formed in each pansporoblast?). Polysporous.

Spore: Oval, with broadly rounded anterior and slightly elongated posterior ends, the latter ending in long and fine tails. Two polar capsules at the anterior portion, are pyriform, small and convergent. Sporoplasm with an iodinophilous vacuole. Dimensions: length 12μ, breadth 8μ, length of the tails 10 to 30μ, length of polar filaments 23 to 40μ.

Remarks: As the description gives the details by which the species can be distinguished from other species, the writer establishes it on an independent basis.

HENNEGUYA MICTOSPORA nov. spec.
[Figs. 546 to 557]

Habitat: Urinary bladder of *Lepomis cyanellus* Raf., *L. humilis* Gir. and *Micropterus salmoides* Lac.; Stony Creek, Ill. (November).

In one out of three (6.5 to 8cm. long) of the first, in one out of two (7 and 9.5cm. long) of the second and in one of the third species, examined in the middle of November, was found the present form. None showed a heavy infection, a number of scattered trophozoites and spores being observed. The host did not show any pathological change.

Vegetative form: Polymorphous. Generally rounded or elongated oval. In small monosporous and disporous forms, the tail of the spores developed inside, is extruded from the body, so that these trophozoites show long processes (Figs. 546, 553, 555). Pseudopodia lobose, and extruded from the entire surface of the body (Fig. 547), tho sometimes they are well formed at one end of the body. Protoplasm is differentiated distinctly into ectoplasm and endoplasm. Ectoplasm is homogeneous and hyaline, forming the outer layer. Endoplasm is of reticular structure. The body is colorless, often yellowish, when the endoplasm is loaded with numerous yellowish coarse granules. The size varies from 6 or 7μ up to 60μ. In a rounded form of 38μ in longest diameter, five pansporoblasts, each developing two spores and many nuclei were observed. In another oval form of 45μ by 60μ in size, numerous nuclei were stained, showing that no development of pansporoblast has yet taken place. Disporous, polysporous and monosporous, tho of rare occurrence.

Spore: Broad spindle shape with attenuated anterior end. Shell rather thin. Each valve has 6 to 8 longitudinal striations on the surface. A long tail composed of two halves, is developed at the posterior end. Two pyriform polar capsules with distinctly visible coiled polar filament opens at the anterior tip. Sporoplasm, finely granular, contains an iodinophilous vacuole which is made distinctly visible by treating with Lugol's solution. When stained two typical nuclei are recognized in the sporoplasm. Dimensions of the fresh spores: length excluding tail 13.5 to 15μ, breadth 8 to 9μ, thickness 6 to 7.5μ, length of tail 30 to 35μ, often up to 40μ, polar capsule 5 to 6μ by 3μ, length of polar filament 40μ.

Genus HOFERELLUS Berg

1898	*Hoferellus*	Berg	1898 : 41
1898	*Hoferia*	Doflein	1898 : 288–289

The characters of the genus are described on page 59.
Type and only species: *Hoferellus cyprini* Doflein.

HOFERELLUS CYPRINI Doflein

[Figs. 577 to 581]

1898	*Hoferia cyprini*	Doflein	1898 : 289–290
1908	*Hoferellus cyprini*	Mercier	1908 : LIII–LIV
1910	*Hoferellus cyprini*	Plehn	1910 : 20–22

Habitat: In lumen and epithelial cells of renal tubules of kidney of *Cyprinus carpio* L.; France and Germany.

Vegetative form: Young trophozoites live in epithelium. Adults free in the urinary tubules. Form rounded or oval. No clear differentiation of protoplasm. Pseudopodium unobserved. Endoplasm contains numerous granules and many nuclei. Each pansporoblast forms two spores. Smaller individuals 20 to 30μ in diameter. Polysporous.

Spore: Pyramidal with two short tail-like processes at the posterior end, which are formed from the shell-valves like those of Henneguya. Between these two processes, rarely small protoplasmic pointed processes occur. Each shell-valve has 9 to 10 longitudinal striations on it. Two polar capsules at the anterior part, show clearly the coiled polar filaments. Sporoplasm has two neclei and an iodinophilous vacuole. Dimensions: total length 10 to 12μ, breadth 8μ, tail-process 2μ long, polar capsule 3μ long.

MYXOSPORIDIA GENERA ET SPECIES INCERTAE

Gen. et spec. incert. Leydig

1851		Leydig	1851 : 222
1894	Gen. et spec. incert.	Gurley	1894 : 186

Habitat: Cysts in the root of tongue of *Chondrostoma nasus* L.; Germany.

Gen. et spec. incert. Leydig

1851		Leydig	1851 : 222
1894	Gen. et spec. incert.	Gurley	1894 : 186

Habitat: Heart (auriculo-ventricular valve) of *Leuciscus rutilus* L.

Gen. et spec. incert. Leydig

1851		Leydig	1851 : 223
1894	Gen. et spec. incert.	Gurley	1894 : 186

Gen. et spec. incert. Heckel et Kner

1851		Heckel and Kner	1851 : 12
1894	Gen. et spec. incert.	Gurley	1894 : 186–187

Habitat: Branchiae of *Lucioperca lucioperca* L.; Austria.

Gen. et spec. incert. Borne

1886		Borne	1886 : 211
1894	Gen. et spec. incert.	Gurley	1894 : 187

Habitat: *Scomber scombrus* L.

Genus incert. MERLUCII Perugia
[Figs. 582 and 583]

1891	*Myxosporidium merlucii*	Perugia	1891 : 22–24
1894	*Myxobolus ? merlucii*	Gurley	1894 : 242–243
1899	*Myxobolus merlucii*	Labbé	1899 : 100

Habitat: Gall-bladder of *Merlucius merlucius* L.; Italy.

Vegetative form: Various form. No differentiation of protoplasm. Disporous (?).

Spore: Oval, with two polar capsules.

Remarks: The species was placed in the genus Myxobolus by previous authors. The figures given by Perugia show that the spores are at least dimorphous. From the habitat and the disporous characters, one should place it rather in one of the genera of the Family Ceratomyxidae.

Genus incert. CONGRI Perugia
[Figs. 584 and 585]

1891	*Myxosporidium congri*	Perugia	1891 : 24–25
1894	Genus incert. *congri*	Gurley	1894 : 182
1912	*Myxobolus congri*	Parisi	1912 : 284

Habitat: Gall-bladder of *Conger conger* L.; Genova.

Vegetative form: Floating in the bladder. Form variable. Movements incessant, slow and ameboid.

Spore: Not described.

Gen. et spec. incert. Linton
[Fig. 590]

1891		Linton	1891 : 359–361
1894	Gen. et spec. incert.	Gurley	1894 : 182–183

Habitat: Subcutaneous tissue of *Notropis megalops* Raf.; Ohio (Black River; September, October).

Vegetative form: Cysts. Globular, discrete or aggregated into clusters, white, with minute patches of black pigment from host; size varying from 2.5mm. (single cyst) to 7mm. by 5mm. (clusters); cyst-membrane composed of connective tissue.

Spore: Top-shaped, somewhat flattened; with pointed anterior and broadly rounded posterior end. Shell thick, with elevated sutural ridge. Polar capsules could not be detected. Protoplasm finely granular. Dimensions: length 17μ, breadth 10μ, thickness 6μ.

Remarks: The cysts and figures of spores given by Linton suggest that it is most probably a unicapsular Myxobolus. As Linton could not detect (?) the polar capsule, tho his figures faintly show the said structure, it is placed in this group.

Gen. et spec. incert. Mingazzini

1892		Mingazzini	1892 : 398
1899		Labbé	1899 : 113

Habitat: Ovarian egg of *Lacerta* sp.

Vegetative form: Ameboid with hyaline pseudopodia and granular protoplasm.

Spore: Not observed.

Gen. et spec. incert. Nufer

1905	*Myxobolus* sp.	Nufer	1905 : 71, 77, 79, 85, 186

Habitat: In the connective tissue of branchia of *Chondrostoma nasus;* Lake of Lucerne. A single cyst in a single host fish.

Vegetative form: Cyst white, and of 1mm. in diameter.

Spore: With two polar capsules at one pole and the sporoplasm. Dimensions or any other characters are not given.

Remarks: Altho Nufer placed the form in the genus Myxobolus, this must be brought into the present group in view of the fact that the iodinophilous vacuole was not detected, and that the observation is too incomplete to place it to any one of the genera.

Gen. et spec. incert. Mavor
[Figs. 586 and 587]

1915		Mavor	1915 : 27–28, 32–33
1916		Mavor	1916 : 553–554

Habitat: Gall-bladder of *Urophycis chuss*; St. Andrews (July to September).

Vegetative form: Mavor writes as follows:

Attached, usually in large numbers, to the epithelium of the bladder, occurs a spherical or ellipsoidal trophozoite which in stained preparations is found to contain numerous nuclei. Very often clusters of *Ceratomyxa acadiensis* are found adhering to the free surface of myxosporidium. In fresh preparations the appearance is that of budding from a parent organism. An examination of sections has shown a sharp division between the myxosporidium and *Ceratomyxa acadiensis*.

Spore: Not found.

Remarks: Mavor supposed that the form under discussion probably was some species of Myxidium or Chloromyxum.

Gen. et spec. incert. Mavor
[Figs. 588 and 589]

1916		Mavor	1916a : 68–69

Habitat: Urinary bladder of *Stizostedion vitreum* Mitch.; Georgian Bay (Canada).

Vegetative form: Free forms vary greatly in shape, being rounded, elongated or branched. The largest individual 200μ. Ectoplasm layer clearly visible, sometimes projecting many bristle-like short processes. Endoplasm contains greenish granules. Trophozoites also attached to the epithelium by means of deeply stainable portion of the body.

Spore: Not observed.

Remarks: Mavor mentions resemblance of the present form to *Myxidium lieberkühni* Bütschli in many respects.

KEYS TO THE GENERA AND SPECIES OF MYXOSPORIDIA

No key to the genera and species of Myxosporidia has been published up to the present time. This is due of course to the difficulties which accompany such an attempt. These difficulties lie chiefly in the incompleteness of the observations and descriptions of the majority of the species of Myxosporidia.

The writer has attempted in the following pages to carry out this task. The key is by no means complete, as is unavoidable in the present state of knowledge concerning this particular group of the Protozoa.

Altho the spore is the fundamental factor used in constructing this key, it was necessary to refer also to some other secondary characters such as vegetative form and habitat.

Some authors are inclined to think that the difference in host species gives an ample basis on which to record the parasite as a new species. In some cases the parasite is specific in a certain host species while in other cases a number of different host species are infected by one and the same parasite. Therefore one can not lay much emphasis upon a difference of hosts in fixing the identification of a Myxosporidian.

KEY TO THE GENERA OF MYXOSPORIDIA

1(6) Spore approximately spherical
  Suborder **Sphaerosporea** Kudo 1919 2
2(3) Spore with four polar capsules
  Family Chloromyxidae Thélohan 1890
  Genus *Chloromyxum* Mingazzini 1890 .... *(183)*
3(2) Spore with two polar capsules
  Family Sphaerosporidae Davis 1917 4
4(5) Sutural line of spore straight
  Genus *Sphaerospora* Thélohan 1892 .... *(185)*
5(4) Sutural line of spore sinuous
  Genus *Sinuolinea* Davis 1917 .... *(186)*
6(1) Spore not spherical 7
7(16) Largest diameter of spore at right angles to sutural line; two polar capsules, one on each side of sutural line
  Suborder **Eurysporea** Kudo 1919
  Family Ceratomyxidae Doflein 1899 8
8(11) Shell-valves prolonged laterally 9
9(10) Shell-valves hemispherical or rounded
  Genus *Leptotheca* Thélohan 1895 .... *(179)*
10(9) Shell-valves conical; free end tapering to a more or less pointed end
  Genus *Ceratomyxa* Thélohan 1892 .... *(180)*
11(8) Shell-valves rather elongated; circular in cross-section 12
12(13) Spore rounded oblong; shell longitudinally striated; polar capsules pyriform, with or without long and fine posterior filaments
  Genus *Mitraspora* Fujita 1912 emend. Kudo 1919 .... *(183)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

13(12) Spore angular, not rounded.. 14

14(15) Spore pyramidal in front view; with its base at anterior end; with or without distinct anterior processes; shell smooth
Genus *Myxoproteus* Doflein 1898..................................*(183)*

15(14) Spore isosceles triangular in front view; anterior end attenuated; polar capsules spherical and large; shell with fine network-like ridges; with posterior fringe-like processes
Genus *Wardia* Kudo 1919..*(183)*

16(7) Largest diameter of spore coincides with or at an acute angle to sutural plane; one or two polar capsules which are in sutural plane
Suborder **Platysporea** Kudo 1919 17

17(22) Spore fusiform; two polar capsules, one at each end of spore
Family Myxidiidae Thélohan 1892 18

18(21) Spore more or less regularly fusiform; shell-valves symmetrical.............. 19

19(20) Polar filament fine and long
Genus *Myxidium* Bütschli 1882..................................*(186)*

20(19) Polar filament thick and short
Genus *Sphaeromyxa* Thélohan 1892...............................*(188)*

21(18) Spore semi-circular in front view; polar filament fine
Genus *Zschokkella* Auerbach 1910...............................*(188)*

22(17) Spore not fusiform; with one or two polar capsules at anterior extremity........ 23

23(26) Sporoplasm without iodinophilous vacuole
Family Myxosomatidae Poche 1913 24

24(25) Spore elongated ovoid in front view; anterior end mostly pointed
Genus *Myxosoma* Thélohan 1892...............................*(189)*

25(24) Spore more or less rounded in front view
Genus *Lentospora* Plehn 1905 ....*(189)*

26(23) Sporoplasm always with iodinophilous vacuole
Family Myxobolidae Thélohan 1892.............................. 27

27(30) Spore with posterior process; shell sometimes striated......................... 28

28(29) Process more or less long, projecting posteriad along median line of spore; process either single or double; shell sometimes striated
Genus *Henneguya* Thélohan 1892...............................*(193)*

29(28) Process short projecting posteriad from sides; shell longitudinally striated
Genus *Hoferellus* Berg 1898.....................................*(173)*

30(27) Spore without posterior process; shell unstriated; one or two polar capsules
Genus *Myxobolus* Bütschli 1882.................................*(189)*

II. KEY TO THE SPECIES

Genus LEPTOTHECA Thélohan 1895

1(14) Spore: sutural diameter always more than half of greatest breadth........... 2

2(7) Average sutural diameter less than 10μ.................................... 3

3(4) Posterior margin of spore concave in front view; sutural diameter 8 to 9μ, breadth 12 to 14μ. Trophozoite usually with a long process
Leptotheca longipes Auerbach 1910..............................*(63)*

4(3) Posterior margin of spore not concave.. 5

5(6) Posterior margin of spore flattened; polar capsules pyriform; sutural diameter 6 to 7μ, breadth 11 to 12μ. Trophozoite with actively motile long filiform pseudopodia at rounded end
Leptotheca agilis Thélohan 1892.................................*(60)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

6(5) Spore regularly ovoidal; polar capsules short pyriform, opening on opposite sides; sutural diameter 9μ, breadth 16μ. Trophozoite pyriform without any recognizable pseudopodium
Leptotheca fusiformis Davis 1917 . . . . . . *(63)*
7(2) Average sutural diameter of spore equal to or larger than 10μ 8
8(13) Shell-valves symmetrically built; sutural ridge straight 9
9(10) Posterior margin of spore concave in front view; sutural diameter 10μ, breadth 18 to 20μ; each spore formed independently
Leptotheca informis Auerbach 1910 . . . . . . *(63)*
10(9) Spore regularly ovoidal 11
11(12) Trophozoite extremely polymorphous. Spore: sutural diameter 10 to 12μ, breadth 18 to 20μ
Leptotheca polymorpha Thélohan 1895 . . . . . . *(61)*
12(11) Typical form of trophozoite elongated; anterior end depressed surrounded by short often branched pseudopodia. Spore: sutural diameter 12 to 15μ, breadth 18 to 20μ
Leptotheca elongata Thélohan 1895 . . . . . . *(60)*
13(8) Shell-valves asymmetrically built; sutural ridge sinuous; sutural diameter 9 to 10μ, breadth 16 to 18μ. Trophozoite rounded; movements slow
Leptotheca lobosa Davis 1917 . . . . . . *(64)*
14(1) Sutural diameter equal to or less than half of greatest breadth 15
15(18) Average sutural diameter smaller than 10μ 16
16(17) Spore arch-shaped in front view; polar capsules pyriform; sutural diameter 3 to 4μ, breadth 8 to 10μ
Leptotheca parva Thélohan 1895 . . . . . . *(61)*
17(16) Spore cylindrical; sutural diameter 4.5μ, breadth 9μ
Leptotheca glomerosa Davis 1917 . . . . . . *(65)*
18(15) Average sutural diameter greater than 10μ 19
19(20) Posterior margin of spore slightly concave in front view; anterior end attenuated; polar capsules pyriform; sutural diameter 13μ, breadth 26μ. Trophozoite rounded; with active amoeboid movements
Leptotheca macrospora Auerbach 1909 . . . . . . *(62)*
20(19) Posterior margin of spore more or less flattened; anterior end smoothly rounded; polar capsules rounded; sutural diameter 11μ, breadth 22μ. Trophozoite elongated; pseudopodia often anastomose
Leptotheca scissura Davis 1917 . . . . . . *(64)*

Incompletely described species
Leptotheca renicola Thélohan 1895 . . . . . . *(61)*
Leptotheca hepseti Thélohan 1895 . . . . . . *(62)*
Leptotheca perlata Gurley 1894 . . . . . . *(62)*
Leptotheca sp. Awerinzew 1908 . . . . . . *(62)*

Genus CERATOMYXA Thélohan 1892

1(52) Spore constant in form and size 2
2(21) Sutural diameter equal to or less than one-eighth of total breadth 3
3(10) Sutural diameter not less than one-tenth of total breadth 4
4(9) Pseudopodia of vegetative form located at rounded end 5
5(6) Pseudopodia long filiform; with slow whiplash-like movements toward pointed extremity. Spore: sutural diameter 12μ, breadth 118μ
Ceratomyxa flagellifera Davis 1917 . . . . . . *(77)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

6(5) Pseudopodia short lobose 7
7(8) Extremities of spore attenuated; spore large; sutural diameter 10 to 12μ, breadth 90 to 100μ
Ceratomyxa sphaerulosa Thélohan 1892 . . . . *(66)*
8(7) Extremities of spore rounded; spore small; sutural diameter 4μ, breadth 34 to 39μ
Ceratomyxa streptospora Davis 1917 . . . . *(79)*
9(4) Pseudopodia unlocalized; from main part of sporulating trophozoite are branched out from one to six long prolongations. Spore: sutural diameter 5 to 7μ, breadth 50μ
Ceratomyxa appendiculata Thélohan 1892 . . . . *(67)*
10(3) Sutural diameter equal to or less than one-tenth of total breadth 11
11(14) Shell-valve terminating in a fine thread-like process at distal end 12
12(13) Sutural diameter 7 to 8μ, breadth 40 to 50μ, lateral process 250 to 300μ
Ceratomyxa acadiensis Mavor 1915 . . . . *(71)*
13(12) Sutural diameter 5μ, breadth 10 to 12μ, length of lateral process 20μ
Ceratomyxa linospora Doflein 1898 . . . . *(69)*
14(11) Shell-valves not terminating in thread-like processes 15
15(20) Shell-valve drawn out into a delicate process 16
16(17) Lateral process ribbon-like; sutural diameter 6μ, breadth 140 to 150μ
Ceratomyxa taenia Davis 1917 . . . . *(74)*
17(16) Lateral process not ribbon-like, but circular in cross-section 18
18(19) Posterior margin of main part of spore flattened; sutural diameter 12μ, breadth 115 to 140μ; trophozoite disporous
Ceratomyxa sphairophora Davis 1917 . . . . *(73)*
19(18) Posterior margin of main part of spore rounded; sutural diameter 7μ, breadth 80μ. Trophozoite monosporous or disporous
Ceratomyxa spinosa Davis 1917 . . . . *(80)*
20(15) Shell-valve tapering gradually to attenuated point; asymmetrical; sutural diameter 9μ, breadth 115μ
Ceratomyxa attenuata Davis 1917 . . . . *(75)*
21(2) Sutural diameter more than one-eighth of total breadth 22
22(45) Sutural diameter equal to or more than one-fifth of breadth 23
23(34) Shell-valves symmetrically built 24
24(29) Shell-valves attenuated at distal end 25
25(26) Pseudopodia peculiar network-like form. Spore: sutural diameter 12 to 20μ, breadth 50 to 80μ
Ceratomyxa ramosa Awerinzew 1907 . . . . *(69)*
26(25) Pseudopodia never unite together 27
27(28) Shell-valves curved greatly posteriad; polar capsules rounded; sutural diameter 8 to 9μ, breadth 16(?)μ. Trophozoite elongated pyriform.
Ceratomyxa recurvata Davis 1917 . . . . *(75)*
28(27) Shell-valves not curved; two thickenings on posterior margin equidistant from sutural line; polar capsules pyriform; sutural diameter 40 to 45μ, thickness 25 to 30μ, breadth 124 to 140μ
Ceratomyxa tylosuri Awerinzew 1913 . . . . *(70)*
29(24) Shell-valve rounded at distal end 30
30(31) Spore arch-shaped; sutural diameter and thickness 12 to 15μ, breadth 50 to 60μ. Trophozoite large amoeboid.
Ceratomyxa spari Awerinzew 1913 . . . . *(70)*
31(30) Spore straight 32

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

32(33) Shell-valves shorter (sutural diameter: breadth = 1:1.6)
Ceratomyxa coris Georgévitch 1916 .... *(72)*
33(32) Shell-valves longer (sutural diameter: breadth = 1:2.6)
Ceratomyxa herouardi Georgévitch 1916 .... *(72)*
34(23) Shell-valves asymmetrically built 35
35(40) Spore arch-shaped in front view 36
36(37) Sutural diameter equal to one-fifth of breadth; sutural diameter 10μ, breadth 50μ
Ceratomyxa globulifera Thélohan 1895 .... *(67)*
37(36) Sutural diameter more than one-fifth of total breadth 38
38(39) Spore: breadth shorter; sutural diameter 14μ, breadth 17μ
Ceratomyxa abbreviata Davis 1917 .... *(76)*
39(38) Spore: breadth longer; sutural diameter 12 to 15μ, breadth 45 to 50μ
Ceratomyxa reticularis Thélohan 1895 .... *(68)*
40(35) Spore straight 41
41(42) Sutural diameter 11μ, breadth 27μ. Trophozoite always rounded
Ceratomyxa amorpha Davis 1917 .... *(78)*
42(41) Sutural diameter 6μ 43
43(44) Trophozoite with active pseudopodia. Spore: sutural diameter 6μ, breadth 22 to 24μ
Ceratomyxa undulata Davis 1917 .... *(79)*
44(43) Trophozoite with inactive pseudopodia. Spore: sutural diameter 6μ, breadth 31μ
Ceratomyxa inaequalis Doflein 1898 .... *(68)*
45(22) Sutural diameter less than one-fifth of total breadth 46
46(49) Breadth of spore equal to or greater than 50μ 47
47(48) Shell-valve tapering gradually toward distal end; sutural diameter 8μ, breadth 50 to 56μ. Trophozoite usually elongated pyriform
Ceratomyxa mesospora Davis 1917 .... *(73)*
48(47) Shell-valve rounded at distal end; sutural diameter 6 to 7μ, breadth 50μ. Trophozoite usually rounded or irregular form; size small
Ceratomyxa aggregata Davis 1917 .... *(79)*
49(46) Breadth of spore smaller than 30μ 50
50(51) Trophozoite ordinarily spherical, diameter not exceeding 16 to 20μ; protoplasm extremely pale looking. Spore: sutural diameter 5μ, breadth 25 to 30μ.
Ceratomyxa pallida Thélohan 1895 .... *(67)*
51(50) Trophozoite pyriform with a long posterior process; movements by wavelike motion of ectoplasm; also active backward movements of pseudopodia. Spore asymmetrically built; sutural diameter 5μ, breadth 24 to 28μ
Ceratomyxa agglomerata Davis 1917 .... *(77)*
52(1) Spore variable in size and form 53
53(54) Variation in number of shell-valves conspicuous; sutural diameter 5μ, breadth 25μ
Ceratomyxa truncata Thélohan 1895 .... *(67)*
54(53) Variable in size and form of spore, but not in number of shell-valve 55
55(60) Trophozoite more or less definite in shape 56
56(59) Trophozoite usually pyriform 57
57(58) Trophozoite disporous. Spore: sutural diameter 7 to 9μ, breadth 15 to 38μ
Ceratomyxa lunata Davis 1917 .... *(76)*
58(57) Trophozoite monosporous or disporous. Spore: sutural diameter 5 to 6μ, breadth 18 to 25μ
Ceratomyxa monospora Davis 1917 .... *(78)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

59(56) Trophozoite always rounded, never pyriform. Spore: sutural diameter 6μ, breadth 16μ

Ceratomyxa navicularia Davis 1917................................*(80)*

60(55) Trophozoite polymorphous................................ 61

61(62) Shell-valves symmetrically built; sutural diameter 5 to 8μ, breadth 20 to 31μ

Ceratomyxa arcuata Thélohan 1892................................*(65)*

62(61) Shell-valves often asymmetrically built; sutural diameter 8 to 14μ, breadth 50 to 80μ

Ceratomyxa drepanopsettae Awerinzew 1907................................*(70)*

Incompletely described species

Ceratomyxa sp. (?) Awerinzew 1913................................*(71)*

Ceratomyxa sp. (?) Awerinzew 1913................................*(71)*

Ceratomyxa sp. Georgévitch 1916................................*(72)*

Genus MYXOPROTEUS Doflein 1898

1(2) Spore with two long (5μ) processes extending anteriad from sides; sutural diameter 9μ, breadth 12μ

Myxoproteus cornutus Davis 1917................................*(82)*

2(1) Spore without long process................................ 3

3(4) Spore with two small spinous processes at anterior end; sutural diameter 25μ, breadth 18 to 20μ

Myxoproteus ambiguus Thélohan 1895................................*(81)*

4(3) Spore without any process; posterior end slightly pointed; sutural diameter 12μ, breadth 10 to 11μ

Myxoproteus cordiformis Davis 1917................................*(81)*

Genus WARDIA Kudo 1919

1 Spore isosceles triangular form; shell with network-like striations which end in fringe-like processes at posterior margin; sutural diameter 9 to 10μ, breadth 10 to 12μ, diameter of polar capsule 4μ.

Wardia ovinocua Kudo 1919................................*(82)*

Doubtfully placed species

Wardia ohlmacheri (Gurley 1894)................................*(83)*

Genus MITRASPORA Fujita 1912 emend. Kudo 1919

1(4) Spore with posterior filaments................................ 2

2(3) Posterior filaments short (5 to 6μ long); length 10μ, breadth 8 to 9μ, thickness 6 to 8μ, polar capsule 4μ by 1.5 to 2μ

Mitraspora cyprini Fujita 1912................................*(84)*

3(2) Posterior filaments of spore long (up to 28μ); length 10 to 11μ, polar capsule 4 to 4.5μ long

Mitraspora caudata Parisi 1910................................*(85)*

4(1) Spore without posterior filament; anterior end slightly attenuated; posterior end truncate; length 15 to 17μ, breadth 5 to 6μ, thickness 4.5 to 5.5μ, polar capsule 7.5μ by 2μ

Mitraspora elongata Kudo 1919................................*(85)*

Genus CHLOROMYXUM Mingazzini 1890

1(4) Spore with posterior appendage................................ 2

2(3) Posterior appendage fine and numerous; length 6 to 9μ, breadth 5 to 6μ, polar capsule 2 to 3μ by 1 to 2μ

Chloromyxum leydigi Mingazzini 1890................................*(87)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

3(2) Posterior appendage single or bifurcated; length 8μ, breadth 6 to 7μ, appendage 10μ long
Chloromyxum caudatum Thélohan 1895 ... *(88)*

4(1) Spore without posterior appendage ... 5

5(34) Spore circular or subcircular in front view; parasitic in body cavity of host ... 6

6(29) Shell-valves marked with striations or ridges ... 7

7(24) Main part of striations or ridges parallel to sutural line ... 8

8(11) Shell-valves partially marked ... 9

9(10) Ridges on each shell-valve variable in number (six found in original drawing) running closely to sutural line; diameter 10.8μ
Chloromyxum dubium Auerbach 1908 ... *(91)*

10(9) Each shell-valve with one ridge from which eight to twelve short ones are directed toward centre of valve; oval in profile; length and breadth 8 to 10μ, thickness 5 to 7μ
Chloromyxum trijugum Kudo 1919 ... *(96)*

11(8) Entire shell-valve marked ... 12

12(19) Shell-valve marked with fine striations ... 13

13(16) Spore oval in lateral view ... 14

14(15) Trophozoite larger; size up to 50μ by 20μ; polysporous (up to eight spores) rarely disporous. Spore: length 8 to 9μ, breadth 6 to 7μ, thickness 5 to 6μ
Chloromyxum misgurni Kudo 1916 ... *(93)*

15(14) Trophozoite smaller; size up to 35μ in diameter; polysporous (up to six spores) or disporous. Spore: length 8μ, breadth 7μ, thickness 5 to 6μ
Chloromyxum catostomi Kudo 1919 ... *(98)*

16(13) Spore circular in lateral view ... 17

17(18) Trophozoite rounded; 40 to 45μ by 28 to 40μ. Spore: diameter 10 to 13μ, polar capsule 4 to 6μ long
Chloromyxum protei Joseph 1905 ... *(90)*

18(17) Trophozoite irregular form; 33 to 35μ in average length. Spore: striations thicker and somewhat wavy; diameter 9 to 9.5μ, polar capsule 3μ long
Chloromyxum thymalli Lebzelter 1912 ... *(92)*

19(12) Shell-valves marked with ridges ... 20

20(21) Trophozoite small (average diameter of adults about 20μ); monosporous, rarely disporous. Spore: shell-valves with ridges marked antero-posteriad; diameter 10 to 11μ
Chloromyxum cristatum Léger 1906 ... *(91)*

21(20) Trophozoite large, diameter reaching 40 to 50μ ... 22

22(23) Ridges on shell-valves united into a line at each end and unequal in thickness; spore small; length 10 to 12μ, breadth 8 to 10μ
Chloromyxum fujitai Kudo 1916 ... *(93)*

23(22) Shell-valve with two circular and two small ridges; spore large; length 16μ, breadth 10μ
Chloromyxum koi Fujita 1913 ... *(92)*

24(7) Striations or ridges not parallel to sutural line ... 25

25(26) Striations irregular; posterior margin thickened at sides; diameter 7.5 to 9μ
Chloromyxum wardi Kudo 1919 ... *(99)*

26(25) Striations parallel to each other ... 27

27(28) Striations forming acute angles with sutural line; diameter 8 to 9μ
Chloromyxum truttae Léger 1906 ... *(90)*

28(27) Four ridges on posterior half of shell-valve converging toward anterior end; diameter 7μ
Chloromyxum granulosum Davis 1917 ... *(96)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

29(6) Shell-valves without marking, beside sutural ridge........................ 30
30(31) Anterior end of spore rounded; diameter 7 to 8μ; one or two short spinous thickenings at posterior margin
Chloromyxum fluviatile Thélohan 1892.............................*(89)*
31(30) Anterior end of spore mucronate or truncate............................ 32
32(33) Anterior end of spore mucronate; length 8μ
Chloromyxum mucronatum Gurley 1893.............................*(89)*
33(32) Anterior end of spore truncate; spore large; length 40 to 48μ, breadth 30 to 38μ
Chloromyxum magnum Awerinzew 1913.............................*(92)*
34(5) Spore rounded quadrangular in end view; conical in front view; parasitic in muscular tissue of fish.. 35
35(36) Length of spore larger than breadth; length 6μ, breadth 5μ
Chloromyxum quadratum Thélohan 1895.............................*(88)*
36(35) Length (sutural diameter) of spore smaller than breadth.................... 37
37(38) Spore variable in form; anterior end narrower or broader than posterior end; length 4 to 4.75μ, breadth 5.4 to 6.5μ
Chloromyxum clupeidae Hahn 1917.................................*(94)*
38(37) Anterior end of spore drawn out; almost circular in end view; length 6μ, breadth 7.5μ
Chloromyxum funduli Hahn 1915..................................*(93)*

Incompletely described species
Chloromyxum diploxyi Gurley 1893...............................*(90)*
Chloromyxum sp. Awerinzew 1908.................................*(91)*

Genus SPHAEROSPORA Thélohan 1892

1(8) Shell-valve of spore without marking except sutural ridge................... 2
2(7) Vegetative form amoeboid.. 3
3(4) Movements of vegetative form active. Spore: sutural ridge fairly well marked; a pair of short filaments become visible at anterior end on warming; diameter 8μ
Sphaerospora masovica Cohn 1902.................................*(101)*
4(3) Vegetative form without active movements.............................. 5
5(6) Spore: sutural ridge not prominent; polar capsule pyriform; diameter 8 to 13μ, polar capsule 4 to 5μ by 2.5 to 3.5μ
Sphaerospora carassii Kudo 1919.................................*(103)*
6(5) Spore: sutural ridge prominent; polar capsule spherical; slightly attenuated at anterior end; diameter 10 to 11μ
Sphaerospora elegans Thélohan 1892...............................*(100)*
7(2) Vegetative form produces cyst in tissue. Spore: diameter 8 to 9μ
Sphaerospora platessae Woodcock 1904.............................*(102)*
8(1) Shell-valves striated.. 9
9(10) Polar capsules divergent; diameter of spore 10 to 12μ, thickness 8μ
Sphaerospora divergens Thélohan 1895.............................*(100)*
10(9) Polar capsules not divergent... 11
11(14) Striation marked antero-posteriad...................................... 12
12(13) Spore with a quadrangular lamella at anterior margin; striations ending in small spines at posterior margin; length 12 to 14μ, breadth 10 to 12μ
Sphaerospora rostrata Thélohan 1895..............................*(101)*
13(12) Spore smooth-contoured; polar capsules parallel to each other; diameter 7 to 10μ
Sphaerospora polymorpha Davis 1917...............................*(102)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

14(11) Faint concentric striations; pointed at sides and middle part of posterior margin; polar capsules unequal in size; length 7 to 8μ, breadth 6 to 7μ, thickness 5μ
Sphaerospora angulata Fujita 1912................................*(102)*

Incompletely described species
Sphaerospora sp. Davis 1917....................................*(103)*
Sphaerospora sp. Southwell et Prashad 1918..........................*(103)*

Genus SINUOLINEA Davis 1917

1(4) Spore with two processes.. 2
2(3) Processes lateral and long (20μ); spore: 9 to 11μ long, 9μ broad, process 18 to 22μ long
Sinuolinea brachiophora Davis 1917..............................*(106)*
3(2) Processes posteriad from sides and short; diameter 12 to 13μ. Trophozoite opaque
Sinuolinea opacita Davis 1917..................................*(106)*
4(1) Spore without process... 5
5(6) Trophozoite with active amoeboid movements. Spore: sutural ridge S-shaped at anterior part; length 15μ, breadth 12μ, thickness 8μ
Sinuolinea arborescens Davis 1917................................*(105)*
6(5) Trophozoite with slow amoeboid movements............................ 7
7(8) Sutural plane much twisted on its axis; capsulogenous cells large occupying more than half of sporal cavity; polar capsules opening on opposite sides; diameter 12 to 14μ
Sinuolinea capsularis Davis 1917.................................*(105)*
8(7) Sutural plane not much twisted; diameter 15μ
Sinuolinea dimorpha Davis 1916.................................*(104)*

Genus MYXIDIUM Bütschli 1882

1(16) Breadth of spore equal to or more than half of length..................... 2
2(7) Shell-valves unstriated.. 3
3(6) Sutural plane curved into an S....................................... 4
4(5) Spore small; length 8 to 12μ, breadth 4 to 6μ
Myxidium incurvatum Thélohan 1892..............................*(108)*
5(4) Spore large; much broader; length 20.8 to 23.4μ, breadth 13 to 15.6μ
Myxidium inflatum Auerbach 1909................................*(111)*
6(3) Sutural plane straight; spore cylindrical; surrounded by a gelatinous envelope; length 10 to 11μ, breadth 6μ
Myxidium glutinosum Davis 1917.................................*(115)*
7(2) Shell-valves striated.. 8
8(9) Sutural line curved into an S; form oval; circular in cross-section; openings of polar capsules pointed; length 11 to 13μ, breadth 8 to 9μ
Myxidium oviforme Parisi 1912...................................*(114)*
9(8) Sutural line straight... 10
10(13) Sutural line coincides with longitudinal axis of spore....................... 11
11(12) Sutural ridge distinct; extremities mucronate; length 9 to 10μ, breadth 5 to 5.6μ, thickness 4.75 to 5μ. Vegetative form produces cysts, 800 to 900μ in diameter
Myxidium giardi Cépède 1906....................................*(110)*
12(11) Sutural ridge faintly marked; extremities gradually drawn out; length 11μ, breadth 8μ. Trophozoite large and leaf-like; diameter up to 1.35 mm.
Myxidium phyllium Davis 1917...................................*(116)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

13(10) Sutural line forming an acute angle with longitudinal axis of spore........... 14

14(15) Shell thickened at extremities; polar capsules ovoidal; length 10 to 14μ, breadth 6 to 8μ, length of polar capsule 4μ
Myxidium striatum Cunha et Fonseca 1917........................*(116)*

15(14) Shell uniformly thick; polar capsules rounded pyriform; length 10 to 12μ, breadth 6μ, length of polar capsule 3 to 4μ
Myxidium macrocapsulare Auerbach 1910..........................*(113)*

16(1) Breadth of spore less than half of length................................ 17

17(34) Breadth more than one-third of length.................................. 18

18(25) Shell-valves unstriated.. 19

19(22) Extremities of spore pointed.. 20

20(21) Spore: extremities sharply pointed; greatly curved; narrow; length 12 to 14μ, breadth 5.5 to 6μ, thickness 2.5 to 3μ
Myxidium depressum Parisi 1912.................................*(114)*

21(20) Spore: extremities not so sharply pointed; not greatly curved; broader; length 16.2 to 19μ, breadth 7 to 9μ
Myxidium bergense Auerbach 1909................................*(112)*

22(19) Extremities of spore not pointed...................................... 23

23(24) Spore larger; length 15 to 20μ, breadth 7 to 8μ
Myxidium sphaericum Thélohan 1895..............................*(109)*

24(23) Spore smaller; length 6(?) to 14μ, breadth 4 to 6μ. Trophozoite mictosporous
Myxidium gadi Georgévitch 1916.................................*(115)*

25(18) Shell-valves striated.. 26

26(33) Spore definite in shape... 27

27(28) Spore constricted in middle part of length; length 15μ
Myxidium histophilum Thélohan 1895.............................*(109)*

28(27) Spore regularly fusiform.. 29

29(30) Vegetative form produces cyst. Spore: length 12 to 15μ, breadth 6μ
Myxidium barbatulae Cépède 1906................................*(110)*

30(29) Vegetative form does not produce cyst................................. 31

31(32) Sutural line slightly curved in S-form; length 15 to 16μ, breadth and thickness 5.5 to 6μ
Myxidium americanum Kudo 1919.................................*(117)*

32(31) Sutural line not curved in S-shape, but bent to one side; length 15 to 18μ, breadth and thickness 6 to 7μ
Myxidium kagayamai Kudo 1919..................................*(117)*

33(26) Spore variable in form; straight and constricted; one side concave, the other convex; arch-shaped, etc.; length 13 to 18μ, breadth 5.2 to 5.8μ
Myxidium pfeifferi Auerbach 1908...............................*(111)*

34(17) Breadth of spore equal to or less than one-third of length.................. 35

35(40) Shell-valves unstriated.. 36

36(37) Spore greatly elongated (breadth: length = 1:6.2); length 21.6 to 25.2μ, breadth 3.6 to 4μ
Myxidium procerum Auerbach 1910................................*(112)*

37(36) Spore less elongated (breadth: length = 1:3 or 1:3.4)...................... 38

38(39) Spore large; valves asymmetrical; length 28μ, breadth 8μ
Myxidium giganteum Doflein 1898................................*(110)*

39(38) Spore small; valves symmetrical; length 12μ, breadth 3 to 4μ
Myxidium danilewskyi Laveran 1897..............................*(109)*

40(35) Shell-valves striated.. 41

41(44) Spore definite in shape... 42

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

42(43) Length of polar capsule more than one-fourth of that of spore; spore 18 to 20μ long, 5 to 6μ broad
Myxidium lieberkühni Bütschli 1882 .... *(107)*

43(42) Length of polar capsule less than one-seventh of that of spore; length 16 to 17μ, breadth 5μ
Myxidium mackiei Bosanquet 1910 .... *(112)*

44(41) Spore variable in shape; S-form, straight fusiform, etc.; length 9.1μ, breadth 2.8μ. Vegetative form produces cyst
Myxidium anguillae Ishii 1915 .... *(114)*

Incompletely described species
Myxidium sp. Gurley 1894 .... *(109)*
Myxidium sp. Awerinzew 1908 .... *(113)*
Myxidium sp. Mavor 1915 .... *(115)*

Genus SPHAEROMYXA Thélohan 1892

1(6) Spore straight, not arch-shaped 2

2(5) Shell-valves symmetrical 3

3(4) Ends of spore truncate; striations longitudinal; length 15 to 20μ, breadth 5 to 6μ.
Sphaeromyxa balbianii Thélohan 1892 .... *(118)*

4(3) Ends of spore rounded; sutural plane forming some angles with longitudinal axis of spore; striations transverse; length 12 to 14μ, breadth 9 to 10μ
Sphaeromyxa immersa Lutz 1889 .... *(119)*

5(2) Shell-valves asymmetrical; unstriated; ends less truncate; dimensions about twice or three times larger than those of *Sphaeromyxa balbianii*
Sphaeromyxa gasterostei Georgévitch .... *(121)*

6(1) Spore arch-shaped, not straight 7

7(8) Shell-valves indistinctly striated; ends truncate; length 22 to 28μ, breadth 3 to 4.3μ
Sphaeromyxa sabrazesi Laveran et Mesnil 1900 .... *(120)*

8(7) Shell-valves unstriated 9

9(10) Spore extremely large; length 75 to 80μ, breadth 18 to 20μ; ends slightly tapering
Sphaeromyxa exneri Awerinzew 1913 .... *(121)*

10(9) Spore less than 35μ in length 11

11(12) Extremities rounded; length 30 to 35μ, breadth 8μ
Sphaeromyxa incurvata Doflein 1898 .... *(119)*

12(11) Extremities truncate; sutural ridge often twisted in S-form; length 20.8 to 26μ, breadth and thickness 5.4μ
Sphaeromyxa hellandi Auerbach 1909 .... *(121)*

Genus ZSCHOKKELLA Auerbach 1910

1(4) Shell-valves unstriated 2

2(3) Openings of polar capsules on flattened side; spore large; length 16 to 28.8μ, breadth 13 to 18μ
Zschokkella hildae Auerbach 1910 .... *(122)*

3(2) Openings of polar capsules at pointed ends; spore small; length 11μ, breadth 7μ
Zschokkella globulosa Davis 1917 .... *(123)*

4(1) Shell-valves striated 5

5(6) Openings of polar capsules at pointed ends; polar capsules spherical; spore larger; length 10 to 14μ, breadth 6 to 7μ
Zschokkella acheilognathi Kudo 1916 .... *(123)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

6(5) Openings of polar capsules on side; polar capsules rounded pyriform; spore smaller; length 9.5 to 11.5μ, breadth 6.5 to 7μ
Zschokkella nova Klokacewa 1914 .... *(122)*

Genus MYXOSOMA Thélohan 1892

1(2) Spore: shell thickened at anterior end; length 12 to 13μ, breadth 7 to 8μ, polar capsule 6 to 7μ by 2 to 3μ. Cysts polymorphous
Myxosoma dujardini Thélohan 1892 .... *(124)*

2(1) Spore: shell of uniform thickness and with seven to ten folds on sutural edge; length 14μ, breadth 8μ, thickness 6μ, polar capsule 8μ by 2μ. Cysts spherical up to 360μ in largest diameter
Myxosoma funduli Kudo 1918 .... *(125)*

Ambiguous form
Myxosoma lobatum Nemeczek 1911 .... *(124)*

Genus LENTOSPORA Plehn 1905

1(8) Spore circular in front view 2

2(3) Vegetative form produces cysts. Spore: length and breadth 6.3 to 7μ, thickness 4.2 to 4.9μ
Lentospora dermatobia Ishii 1916 .... *(127)*

3(2) Vegetative form does not produce cysts or cysts unobserved 4

4(5) Spore small; trophozoites found in the blood vessel of the brain. Spore 5 to 5.5μ in diameter.
Lentospora encephalina Mulsow 1911 .... *(126)*

5(4) Spore large, greater than 7.5μ in average diameter 6

6(7) Spore slightly pointed at anterior end; length 8 to 10μ, breadth 7 to 8μ, thickness 5 to 6μ
Lentospora acuta Fujita 1912 .... *(127)*

7(6) Anterior end of spore rounded; diameter 6 to 10μ
Lentospora cerebralis Plehn 1905 .... *(125)*

8(1) Spore oval in front view 9

9(10) Spore symmetrically built; length 12μ, breadth 9.5μ, thickness 6μ
Lentospora multiplicata Reuss 1906 .... *(126)*

10(9) Spore asymmetrically built; length 10 to 11μ, breadth 6.5 to 7μ
Lentospora asymmetrica Parisi 1912 .... *(126)*

Genus MYXOBOLUS Bütschli 1882

1(18) Spore with one polar capsule 2

2(9) Breadth of spore equal to or more than half of length 3

3(6) Breadth of spore equal to half of length 4

4(5) Spore larger; often calabash-shaped; anterior end drawn out into a rounded tip; shell thickened at tip; length 15μ, breadth 7 to 8μ, thickness 5 to 6μ
Myxobolus toyamai Kudo 1915 .... *(131)*

5(4) Spore smaller; anterior end pointed; shell of uniform thickness; length 9 to 10μ, breadth 4.5 to 5.5μ, thickness 3μ
Myxobolus oculi-leucisci Trojan 1909 .... *(130)*

6(3) Breadth of spore more than two-thirds of length 7

7(8) Polar capsule small and oblique in position
Myxobolus unicapsulatus Gurley 1893 .... *(129)*

8(7) Polar capsule long and median in position; spore broader; length 13.2 to 13.6μ, breadth 10.1 to 10.3μ
Myxobolus seni Southwell et Prashad 1918 .... *(132)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

9(2) Breadth of spore less than half of length 10

10(17) Breadth of spore more than two-fifths of length 11

11(16) Spore without any process 12

12(15) Shell of uniform thickness 13

13(14) Spore bent to one side; shell thickened at slightly rounded anterior tip; sutural edge without marking; length 16 to 18μ, breadth 7 to 8μ, polar capsule 5 to 7μ long
Myxobolus piriformis Thélohan 1892 .... *(129)*

14(13) Spore straight; shell thickened at posterior part; sutural edge with four to six markings; length 18 to 20μ, breadth 8μ, thickness 6μ, polar capsule 9 to 10μ long
Myxobolus fuhrmanni Auerbach 1909 .... *(130)*

15(12) Shell of uniform thickness; valves symmetrical; sutural edge with markings up to 12 in number; spore 14 to 15.5μ long, 6 to 7.3μ broad, 5 to 6μ thick, polar capsule 6.3μ by 2 to 3μ
Myxobolus misgurni Kudo 1919 .... *(133)*

16(11) Spore with a posterior process, 5μ in length and as broad as spore; length 17 to 18μ, breadth 7.5 to 8μ, polar capsule 7μ by 4μ
Myxobolus notatus Mavor 1916 .... *(131)*

17(10) Breadth of spore about one-fourth of length; spore large; polar capsule extremely large; length 30 to 32μ, breadth 7 to 8μ, length of polar capsule 22 to 23μ
Myxobolus rohitae Southwell et Prashad 1918 .... *(132)*

18(1) Spore with two polar capsules 19

19(24) Form of spore variable 20

20(23) Spore with an intercapsular appendix at anterior end 21

21(22) Spore oval; length 10 to 12μ, breadth 8 to 9μ, thickness 6μ, polar capsule 5μ by 2 to 3μ
Myxobolus mülleri Bütschli 1882 .... *(128)*

22(21) Spore pyriform or elongated oval; length 11 to 16μ, breadth 8 to 13μ, polar capsule 6μ by 4μ
Myxobolus cycloides Gurley 1893 .... *(140)*

23(20) Spore without intercapsular appendix; circular form 7 to 8μ, breadth 8 to 10μ, thickness 6μ, polar capsule 4 to 5μ by 2μ
Myxobolus hylae Johnston et Bancroft 1918 .... *(153)*

24(19) Form of spore definite 25

25(28) Polar capsules in each spore regularly of considerably different size 26

26(27) Spore with an intercapsular appendix; anterior end rounded; sutural edge with folds (3 to 5); length 10 to 12μ, breadth 8μ
Myxobolus dispar Thélohan 1895 .... *(135)*

27(26) Spore without intercapsular appendix; anterior end pointed; no fold on sutural edge
Myxobolus inaequalis Gurley 1893 .... *(135)*

28(25) Polar capsules approximately of equal form and size 29

29(30) Sutural diameter smaller than breadth; length 6 to 7μ, breadth 8μ
Myxobolus transovalis Gurley 1893 .... *(139)*

30(29) Length equal to or more than breadth of spore 31

31(102) Length longer than breadth 32

32(37) Breadth of spore less than half of length 33

33(34) Extremities of spore equally pointed; length 13 to 14.5μ, breadth 6 to 7μ, polar capsule 4.5μ long
Myxobolus miyairii Kudo 1919 .... *(155)*

34(33) Anterior end of spore attenuated; posterior end rounded 35

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

35(36) Shell thickened at posterior margin; spore 12 to 15μ long, 4 to 6.8μ broad, polar capsule 5.5 to 7μ by 2.1 to 2.5μ
Myxobolus anurus Cohn 1895 .... *(142)*
36(35) Shell of uniform thickness; spore 14.3μ long, 6.7μ broad, polar capsule 6.5μ by 2μ
Myxobolus funduli Kudo 1919 .... *(151)*
37(32) Breadth of spore greater than half of length 38
38(41) Length of spore greater than 20μ 39
39(40) Spore large; subcircular and anterior end flattened in front view; sutural edge with markings; length 38 to 45μ, breadth 32 to 38μ, thickness 28 to 35μ, polar capsule 15 to 17μ long
Myxobolus magnus Awerinzew 1913 .... *(150)*
40(39) Spore small; extremities equally rounded; length 21μ, breadth 15μ, polar capsule 6μ long
Myxobolus cyprini Doflein 1898 .... *(143)*
41(38) Length of spore less than 20μ 42
42(43) Spore with a wide (2 to 3μ) membraneous posterior process; length 12μ, breadth 10μ, length of polar capsule 4.5μ
Myxobolus cordis Keysselitz 1908 .... *(148)*
43(42) Normal spore without appendage 44
44(49) Breadth of sutural ridge one-third of thickness of spore 45
45(46) Length of spore smaller than 10μ; subcircular in front view; length 7 to 8μ, breadth 6 to 7μ, thickness 5μ
Myxobolus globosus Gurley 1893 .... *(139)*
46(45) Length of spore greater than 10μ 47
47(48) Spore large; elliptical in front view; with an intercapsular appendix, sutural edge with markings; length 16.9 to 21.6μ, breadth 13 to 16.2μ, thickness 9μ
Myxobolus gigas Auerbach 1906 .... *(145)*
48(47) Spore small; subcircular in front view; markings on entire sutural edge; length 10.8 to 11.7μ, breadth 9.9 to 10.4μ, thickness 7.2 to 9μ
Myxobolus aeglefini Auerbach 1906 .... *(144)*
49(44) Sutural ridge narrower 50
50(69) Spore with an intercapsular appendix 51
51(68) Intercapsular appendix triangular 52
52(57) Anterior end of spore attenuated in front view 53
53(54) Sutural edge without marking; length 11 to 12μ, breadth 9.25 to 10.5μ
Myxobolus balleri Reuss 1906 .... *(147)*
54(53) Sutural edge with markings 55
55(56) Spore small; length 8 to 9.5μ, breadth 6 to 7.5μ, thickness 5.5μ
Myxobolus exiguus Thélohan 1895 .... *(136)*
56(55) Spore large; often subcircular; length 11.5μ to 12μ, breadth 7.5 to 8μ, thickness 5μ
Myxobolus obesus Gurley 1893 .... *(140)*
57(52) Anterior end of spore broadly rounded in front view 58
58(59) Posterior portion of spore narrower; polar capsule rather large; length 11.4 to 13.5μ, breadth 9.5 to 11μ, thickness 8.5 to 9.5μ, polar capsule 5.5 to 6μ long
Myxobolus discrepans Kudo 1919 .... *(156)*
59(58) Extremities of spore approximately equal 60
60(61) Sutural edge without markings; spore 10 to 10.5μ long, 8 to 8.5μ broad, polar capsule 4.5μ long
Myxobolus squamae Keysselitz 1908 .... *(147)*
61(60) Sutural edge with markings 62
62(65) Markings distinct 63

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

63(64) Marking variable in number along posterior margin of spore; spore more elongated; length 12 to 12.5μ, breadth 10 to 10.5μ, polar capsule 5.5 to 6μ long
Myxobolus pfeifferi Thélohan 1895................................(133)
64(63) Sutural edge with four markings around posterior margin; spore rather short; length 11 to 12μ, breadth 9 to 9.5μ, thickness 4.5 to 5μ, polar capsule 5μ by 2.5μ
Myxobolus scardinii Reuss 1906................................(146)
65(62) Markings indistinct................................ 66
66(67) Markings about five at posterior margin; spore larger and shorter; length 11 to 12μ, breadth 9.25 to 10μ, thickness 4.5 to 5.5μ, polar capsule 4 to 5μ by 2.25μ
Myxobolus bramae Reuss 1906................................(147)
67(66) Markings many along entire sutural edge except anterior tip; spore smaller, longer and thicker; length 9.25 to 10μ, breadth 7 to 7.25μ, thickness 5 to 5.5μ, polar capsule 4.5μ by 2.5 to 3μ
Myxobolus cyprinicola Reuss 1906................................(147)
68(51) Intercapsular appendix rounded; sutural edge smooth; length 11μ, breadth 8μ, polar capsule 4 to 6μ long
Myxobolus musculi Keysselitz 1908................................(148)
69(50) Spore without intercapsular appendix................................ 70
70(75) Length of spore less than 10μ................................ 71
71(72) Spore very much flattened and small; length 6μ, breadth 4.2 to 5μ, polar capsule 3μ by 2μ
Myxobolus minutus Nemeczek 1911................................(150)
72(71) Thickness of spore about half of length................................ 73
73(74) Shell thick; length 9.25 to 10μ, breadth 7.25 to 8.25μ, thickness 4 to 5μ
Myxobolus sandrae Reuss 1906................................(146)
74(73) Shell thin; spore 8.25 to 9.5μ long, 7.25 to 8.25μ broad, 4.5 to 5.5μ thick
Myxobolus volgensis Reuss 1906................................(145)
75(70) Length of spore greater than 10μ................................ 76
76(85) Extremities of spore approximately equal................................ 77
77(80) Spore elongated (breadth: length = 1:1.8 or 1:1.4)................................ 78
78(79) Spore larger; length 14 to 17μ, breadth 8.5μ, thickness 5 to 6μ
Myxobolus oblongus Gurley 1893................................(139)
79(78) Spore smaller; length 12 to 15μ, breadth 9 to 11μ
Myxobolus ellipsoides Thélohan 1892................................(136)
80(77) Spore shorter (breadth: length = 1:1.3, 1:1.2 or 1:1.1)................................ 81
81(82) Sutural edge with markings; slightly truncate at anterior end in front view; spore 9.5 to 11.5μ long, 8.5 to 9.5μ broad, 6.5μ thick, polar capsule 4.75μ by 1.5 to 2μ
Myxobolus mesentericus Kudo 1919................................(157)
82(81) Sutural edge without markings................................ 83
83(84) Polar capsule larger; spore 13.9μ long, 11μ broad, 8μ thick
Myxobolus lintoni Gurley 1893................................(138)
84(83) Polar capsules smaller; spore 14.5μ long, 11.9μ broad, polar capsule 6μ by 3.7μ
Myxobolus pleuronectidae Hahn 1917................................(152)
85(76) Anterior end of spore more attenuated than posterior................................ 86
86(89) Sutural edge with markings................................ 87
87(88) Markings five or six in number; spore 17 to 18μ long, 10 to 13μ broad, polar capsule 7 to 8μ
Myxobolus permagnus Wegener 1910................................(149)
88(87) Markings sometimes present; spore 13 to 17μ long, 8 to 10μ broad, 5 to 7μ thick, polar capsule 6 to 7μ long
Myxobolus carassii Klokacewa 1914................................(150)

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

89(86) Sutural edge without markings.. 90
90(99) Anterior end of spore highly attenuated.................................. 91
91(96) Length of polar capsule equal to or less than half of that of spore........... 92
92(93) Spore: anterior end pointed; length 12.4 to 13.5μ, breadth 6.5 to 7.5μ, thickness 5μ, polar capsule 6 to 7μ long. Cysts of bright golden color
Myxobolus aureatus Ward 1919.................................*(154)*
93(22) Anterior tip of spore not pointed.. 94
94(95) Spore greater in thickness (6.5 to 7μ), length 12 to 13μ, breadth 8.25 to 9μ, polar capsule 6μ by 2.5μ; anterior end more rounded
Myxobolus physophilus Reuss 1906..............................*(146)*
95(94) Spore smaller in thickness (5.5μ), length 11 to 13μ, breadth 8.25 to 9.25μ, polar capsule 6μ by 2.5 to 3μ; anterior end less rounded
Myxobolus macrocapsularis Reuss 1906..........................*(146)*
96(91) Length of polar capsule greater than half of that of spore.................. 97
97(98) Length of polar capsule greater than two-thirds of that of spore; spore 16μ long, 10 to 11μ broad, polar capsule 11μ by 4μ
Myxobolus capsulatus Davis 1917...............................*(152)*
98(97) Length of polar capsule less than two-thirds of that of spore; spore 14 to 16μ long, 8 to 9μ broad, 5 to 6μ thick, polar capsule 8 to 9μ by 2.5 to 3μ
Myxobolus koi Kudo 1919.......................................*(155)*
99(90) Anterior end of spore rounded... 100
100(101) Cysts: size up to 1.7 mm. by 0.7 mm.; parasitic in various tissues of host. Spore 10 to 12μ long, 9μ broad
Myxobolus oviformis Thélohan 1892.............................*(137)*
101(100) Cysts: 0.9 mm. by 0.02 mm.; parasitic in nervous system. Spore 10 to 12μ long, 8μ broad, 6μ thick, polar capsule 6 to 7μ by 2μ
Myxobolus neurobius Schuberg et Schröder 1905...................*(144)*
102(31) Spore almost circular in front view...................................... 103
103(104) Anterior end somewhat attenuated; sutural edge with four markings; spore 9 to 10μ long and broad, 6.5 to 7μ thick, polar capsule 6 to 7.5μ by 2.5 to 3μ
Myxobolus orbiculatus Kudo 1919................................*(155)*
104(103) Spore regularly circular in front view................................... 105
105(106) Cysts large, up to 3 mm. by 1.5 mm. Spore 10μ long, 9.8μ broad, 3μ thick, polar capsule 3.8 to 5μ long
Myxobolus rotundus Nemeczek 1911..............................*(149)*
106(105) Cysts small, up to 0.33 mm. in diameter. Spore 9μ in diameter
Myxobolus sphaeralis Gurley 1893...............................*(141)*

Incompletely described species

Myxobolus sp. Gurley 1894.......................................*(142)*
Myxobolus sp. Gurley 1894.......................................*(142)*
Myxobolus sp. Gurley 1894.......................................*(143)*
Myxobolus sp. Miyairi 1909......................................*(149)*
Myxobolus sp. Wegener 1910......................................*(149)*
Myxobolus sp. Lebzelter 1912....................................*(150)*
Myxobolus sp. Southwell 1915....................................*(151)*
Myxobolus sp. Kudo 1918...*(132)*

Genus HENNEGUYA Thélohan 1892

1(10) Parasitic in urinary bladder or urinary tubule of kidney of host............. 2
2(7) Shell-valves striated.. 3

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

3(6) Length of tail equal to two-thirds of length of main part of spore* 4
4(5) Shell-valves asymmetrical; spore smaller; total length 38 to 48μ, length of main part 15μ, breadth 6 to 7.5μ, polar capsule 7.5 to 9μ by 3 to 3.5μ. Trophozoite disporous and polysporous
Henneguya gasterostei Parisi 1912................................*(169)*
5(4) Shell-valves symmetrical; spore broader; length of main part 13.5 to 15μ, breadth 8 to 9μ, thickness 6 to 7.5μ, polar capsule 5 to 6μ by 3μ, length of tail 30 to 40μ. Trophozoite mictosporous
Henneguya mictospora Kudo 1919................................*(173)*
6(3) Length of tail equal to half of length of main part of spore and single(?); length 20 to 24μ, breadth 5 to 6μ, length of polar capsule 4 to 5μ
Henneguya media Thélohan 1892 ....*(161)*
7(2) Shell-valves unstriated.. 8
8(9) Spore elongated; polar capsule longer; posterior portion of main part broad; tail wider and bifurcated to same direction; total length 19.5 to 22.5μ, length of main part 8.5μ, breadth 6μ, length of tail 8 to 8.5μ
Henneguya lĕgeri Cépède 1905................................*(166)*
9(8) Spore oval; polar capsule shorter; posterior part of main portion narrow; tail narrower and bifurcated to opposite directions; length of main part 11.5μ, breadth 7μ, length of tail 9.6μ, polar capsule 3.5μ by 2.5μ
Henneguya wisconsinensis Mavor et Strasser 1916..................*(170)*
10(1) Parasitic in tissue of host.. 11
11(28) Tail always appears as a single process................................ 12
12(13) Spore small; length 4μ, breadth 2μ
Henneguya tenuis Vaney et Conte 1901............................*(166)*
13(12) Spore longer and larger, at least 27μ long................................ 14
14(15) Sutural edge with eight to ten markings; tail rather long; length of main part 10 to 11.5μ, breadth 8 to 8.75μ, thickness 4 to 5μ, polar capsule 3 to 4μ by 2μ, tail up to 17μ long
Henneguya brachyura Ward 1919................................*(171)*
15(14) Sutural edge without markings.. 16
16(19) Total length of spore greater than 40μ.................................. 17
17(18) Anterior end rounded; polar capsule large; shell-valves asymmetrical; tail long; main part 10 to 11μ long, 6 to 8μ broad, 4μ thick, tail 30 to 40μ long. Cysts elongated and large up to 6 mm. by 2 mm.
Henneguya macrura Gurley 1894................................*(164)*
18(17) Anterior end attenuated; polar capsule smaller; shell-valves symmetrical; tail shorter; length 20μ, breadth 8 to 9μ, polar capsule 8μ by 2 to 3μ. Cysts elongated oval and smaller, 1.1 mm. by 0.5 mm.
Henneguya creplini Gurley 1894................................*(162)*
19(16) Total length of spore less than 40μ.................................. 20
20(21) Tail about one-third of main part; total length 38μ, main part 26μ long, 10 to 11μ broad, 8μ thick, polar capsule 11 to 14μ by 2 to 3μ. Cysts oval, numerous and small (130μ by 115μ)
Henneguya minuta Cohn 1895................................*(160)*
21(20) Tail about three-sevenths of main part; total length 29 to 40μ, main part 15 to 20μ long, 7 to 8μ broad, polar capsule 8μ by 2μ........................ 22
22(25) Cysts large.. 23

*Length of main part of spore denotes in all possible cases the distance between the outer anterior tip and the posterior margin of sporal cavity; and consequently that between the latter and the distal end of the tail is the length of the tail.

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

23(24) Cysts spherical up to 6 mm. in diameter; parasitic in ovary
Henneguya oviperda (Cohn 1895) .... *(160)*
24(23) Cysts elongated up to 2 mm. by 1.5 mm.; parasitic in branchia
Henneguya psorospermica Thélohan 1895 .... *(158)*
25(22) Cysts rather small or size not observed 26
26(27) Elongated cysts 0.75 mm. by 0.375 mm.; parasitic in branchia
Henneguya texta (Cohn 1895) .... *(159)*
27(26) Parasitic in intestinal wall
Henneguya peri-intestinalis Cépède 1906 .... *(161)*
28(11) Tail composed of two processes 29
29(30) Total length reaches 87.5 to 110.5μ; length of main part 10.5 to 15μ, breadth 5μ, length of polar capsule 5μ, length of tail 75 to 100μ
Henneguya gigantea Nemeczek 1911 .... *(168)*
30(29) Total length of spore less than 82μ 31
31(34) Sutural edge with markings 32
32(33) Tail longer and spore larger; anterior end more rounded; total length 47μ. Cysts spherical and large, up to 6 mm.
Henneguya salminicola Ward 1919 .... *(171)*
33(32) Tail shorter and spore smaller; anterior end slightly more attenuated; total length 32μ. Cysts lenticular, up to 2 mm. in length
Henneguya nüsslini Schuberg et Schröder 1905 .... *(166)*
34(31) Sutural edge without markings 35
35(38) Distal end of tail thread-like 36
36(37) Tail 40 to 50μ in length; total length 50 to 60μ, main part 8.5 to 9.5μ long, 8.5 to 9.5μ broad, polar capsule 4.7 to 5.5μ by 3μ. Cysts small, up to 50μ in diameter
Henneguya neapolitana Parisi 1912 .... *(170)*
37(36) Tail 10 to 30μ in length; main part 12μ long, 8μ broad
Henneguya miyairii Kudo 1919 .... *(172)*
38(35) Distal end of tail tapers to a point and not thread-like 39
39(40) Cysts irregular in shape; size up to 2.5 mm. Spore: total length 30 to 40μ, main part 11.5 to 15μ long, 5 to 6.5μ broad, polar capsule 6.5 to 8μ by 2 to 2.5μ, tail 22 to 28μ
Henneguya lobosa (Cohn 1895) .... *(161)*
40(39) Cysts spherical or oval 41
41(42) Anterior end of spore rounded; tail either single or double processes; total length 55μ, length of main part 10μ, breadth 7μ, length of tail 40 to 50μ. Cysts spherical or oval up to 32 mm. by 16 mm.
Henneguya zschokkei (Gurley 1893) .... *(165)*
42(41) Anterior end attenuated; spore large; main part 20 to 22μ long, breadth 8 to 9μ, 6 to 7μ thick, polar capsule 10μ by 2 to 3μ, tail 50 to 60μ long
Henneguya acerinae Schröder 1906 .... *(167)*

Incompletely described species

Henneguya schizura (Gurley 1893) .... *(162)*
Henneguya linearis (Gurley 1893) .... *(163)*
Henneguya gurleyi Kudo 1893 .... *(163)*
Henneguya monura (Gurley 1893) .... *(164)*
Henneguya strongylura (Gurley 1894) .... *(163)*
Henneguya kolesnikovi (Gurley 1894) .... *(164)*
Henneguya brevis Thélohan 1895 .... *(162)*
Henneguya sp. (Gurley 1894) .... *(165)*
Henneguya sp. (Gurley 1894) .... *(165)*
Henneguya sp. Nemeczek 1911 .... *(169)*

Numbers enclosed in parentheses refer to the page of the article on which is found the description of the species named.

SUMMARY

1) All species of Myxosporidia which have been observed in various parts of the world, reaching 237 in number, are recorded with figures.

2) A new classification of Myxosporidia is proposed after discussion of those of previous authors.

3) A complete list of the specific names of the hosts that harbor Myxosporidia, is given together with the names of the organ of infection and the localities from which recorded.

4) By study of the geographical distribution of Myxosporidia, it is shown that few species are common both to American and European waters or Asiatic and European waters, while the majority of Myxosporidia are localized in definite and limited regions.

5) The study of the organal distribution of Myxosporidia in the host, shows that the gall-bladder is the organ most frequently invaded by the parasite. The kidney, branchia and urinary bladder have less chances of being attacked.

6) One new genus, Wardia, is established.

7) Nine new species; *Wardia ovinocua*, *Mitraspora elongata*, *Chloromyxum trijugum*, *Chloromyxum catostomi*, *Myxidium americanum*, *Myxobolus orbiculatus*, *Myxobolus discrepans*, *Myxobolus mesentericus* and *Henneguya mictospora*, are described from fresh-water fish collected in the vicinity of Urbana, Ill.

8) Six new species; *Sphaerospora carassii*, *Myxidium kagayamai*, *Myxobolus misgurni*, *Myxobolus miyairii*, *Myxobolus koi* and *Henneguya miyairii*, are recorded from fresh-water fish of Nippon.

9) One new species; *Chloromyxum wardi*, is described from Alaska. This is the second species of Myxosporidia from that part of North America.

10) Keys to the genera and species of known Myxosporidia are included.

APPENDIX: NEW MYXOSPORIDIA FROM AUSTRALIA

The following six species described by Johnston and Bancroft did not reach the writer until the page proof was read. For this reason they could not be put in the text and are recorded here separately.

MYXIDIUM THERAPON Johnston et Bancroft

1919 *Myxidium therapon* Johnston and Bancroft 1919 : 520–521

Habitat: In the gall bladder of *Therapon carbo* and *Th. hillii;* Thomson River at Longreach, Australia.

The parasite occurred in one specimen of the former host fish and in nine out of thirteen specimens of the latter. No visible effect of the infection on the part of the host fish was recognized.

Vegetative form: Body pale yellowish to green in color. Form(?). Size varies from 3 to 12mm. in diameter. The protoplasm is differentiated into a clear narrow ectoplasm, about 10μ in width, and a coarsely grained endoplasm. No movements could be seen on slides; but undulations were observed to travel round the margin of the trophozoite. Polysporous.

Spore: Spindle-shaped with slightly pointed extremities. Polar capsules are more or less rounded. Shell with faintly marked longitudinal striation. The sporoplasm is binucleated. Average dimensions: length 9 to 10μ, breadth 4μ, polar capsules 2 to 3μ by 1 to 2μ.

MYXOSOMA OGILBYI Johnston et Bancroft

1919 *Myxosoma ogilbyi* Johnston and Bancroft 1919 : 521–522

Habitat: In the fibrous tissue of the gill arch of *Plectroplites ambiguus;* Thomson River at Longreach, Australia. Three out of nine host specimens examined showed the infection.

Vegetative form: The parasite forms white cysts usually close to the bases of the gill filaments. Cysts are small and rounded, being less than 1mm. in diameter. The authors simply mention that sections revealed the structure usually present in a Myxosporidian cyst.

Spore: Oval with pointed anterior end. The inner margin of the shell is indented posteriad. The sporoplasm contains a single nucleus, but not any iodinophilous vacuole. Average dimensions: length 11 to 13μ, breadth 6 to 8μ, thickness 5μ, polar capsules 5 to 6μ by 2μ.

MYXOBOLUS PLECTROPLITES Johnston et Bancroft

1919 *Myxobolus plectroplites* Johnston and Bancroft 1919 : 522–523

Habitat: In the kidney and gall-bladder of *Plectroplites ambiguus;* Thomson River at Longreach, Australia. The parasite was observed in four out of nine host fish examined; in two cases in the kidney only, in one case only in the gall-bladder, and in one instance in both gall-bladder and kidney. Cysts were found in the kidney, while only spores were recognized in the gall-bladder.

Vegetative form: The cysts which could only be detected in sections, lie in the connective tissues of kidney. They are of minute size, ranging somewhat widely from 36μ in diameter to 144 by 100μ. According to the authors no definite structure could be found.

Spore: Rounded oval. It bears quite a close resemblance to that of *Myxobolus hylae* (page 153), which is slightly longer, and which has a longer polar filament than the present form. The vacuole, however, is apparently not iodinophilous(?). Average dimensions: length 10 to 12μ, breadth 7 to 8μ, polar capsules 5 by 2μ, length of polar filament 30 to 40μ.

HENNEGUYA AUSTRALIS Johnston et Bancroft

1919 *Henneguya australis* Johnston and Bancroft 1919 : 523–524

Habitat: In the branchiae of *Plectroplites ambiguus;* Thomson River at Longreach, Australia. The parasite was detected in four out of nine host fish examined. The infection was extremely light in all cases.

Vegetative form: The parasites form cysts. They lie embedded in the spongy mass of the gill filament, and in many cases occupy a relatively large area of the section. Cysts showed two layers in section; the outermost clear ectoplasm and inner endoplasm with developing spores, the central portion of which being filled with mature spores. The spores appear to lie in a definite manner, the long axis of the spore commonly being at right angles to the boundary of the cyst, the anterior end of the spore pointing outwards.

Spore: Elongated ovoidal. Anterior end pointed, posterior end drawn out into a tail. The tail appears single when the spore is removed from the cyst but separates soon afterward into two halves which usually diverge widely. Two polar capsules parallel to each other are quite frequently of different length. The sporoplasm contains two nuclei and a small vacuole (iodinophilous?). Average dimensions: length 11 to 15μ, breadth 3 to 5μ, thickness 3 to 4μ, polar capsules 5 to 6μ by 1 to 2μ, length of tail about 20μ.

HENNEGUYA GRACILIS Johnston et Bancroft

1919 *Henneguya gracilis* Johnston and Bancroft 1919 : 524–526

Habitat: In the gill filament of *Therapon hillii;* Thomson River at Longreach, Australia. Out of thirteen specimens examined, eight were infected. Heavy infection was recognized only in one case.

Vegetative form: The cyst is of definite, narrow, pear-shaped form, and lie transversely, i.e., at right angles to the long axis of the gill filament.

Spore: The spore resembles *Henneguya australis*, but is slightly smaller, while the tail is longer in proportion. The spores are arranged with long axis parallel to that of the cyst. Average dimensions: length 10 to 14μ, breadth 2.5 to 3μ, thickness 3μ, polar capsules 5 to 6μ by 1 to 2μ, length of tail about 20 to 26μ.

HENNEGUYA sp. Johnston et Bancroft

1919 *Henneguya* sp. Johnston and Bancroft 1919 : 526

Habitat: In the branchiae of *Nematalosa elongata;* Thomson River at Longreach, Australia.

The authors state that they observed a number of spores of a Henneguya in the scrapings of the gill of one of four host fish.

Vegetative form: Undescribed.

Spore: Undescribed.

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1898b. *Myxobolus bicaudatus* n. sp., ein Parasit der Coregoniden des Vierwaldstattersees. Mitt. Naturf. Ges., Luzern, p. 205–217.
1900. *Myxobolus psorospermicus* Thélohan im Vierwaldstattersee. Mitt. Naturf. Ges. Luzern, p. 441–442.
ZSCHOKKE, F. and A. HEITZ.
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GENERAL EXPLANATION OF FIGURES

For the type species of each genus, both the vegetative form and the spore are illustrated. For the other species, except those which are new, figures of the spore are given, unless the vegetative forms are different from those of the type species or the species were reported in papers which seem to be of less universal distribution.

The original drawings were made with the Abbe drawing apparatus. The combinations used were Zeiss apochromatic objectives 16, 8, 3, and homogeneous oil immersion 2 mm. with compensation oculars 2, 4, 6, 8, 12 and 18. All the other drawings were copied from the original figures of the respective observers, an exact citation of which is given in each case, and were also made with the same drawing apparatus on the same scale except that a few figures were enlarged among those that were taken from other authors.

Magnifications were also calculated and given for those quoted figures, for which the respective authors failed to mention the scale at which the drawings were made.

PLATE I

EXPLANATION OF PLATE

Figs. 1 to 5. *Leptotheca agilis.*

Fig. 1. A typical trophozoite *in vivo.* After Thélohan (1895, Fig. 29); ×750.

Fig. 2. A young form. After Thélohan (1895, Fig. 31). ×750.

Fig. 3. A trophozoite in motion. After Doflein (1898, Fig. 5).

Fig. 4. A trophozoite in contracted condition. After Doflein (1898, Fig. 7).

Fig. 5. A fresh spore. After Thélohan (1895, Fig. 30). ×1500.

Fig. 6. A fresh mature spore of *Leptotheca elongata.* After Thélohan (1895, Fig. 38). ×1500.

Fig. 7. A fresh mature spore of *Leptotheca parva.* After Thélohan (1895, Fig. 25). ×1500.

Fig. 8. A fresh spore of *Leptotheca perlata.* After Balbiani (1884, Fig. 40).

Fig. 9. A spore of *Leptotheca macrospora.* After Auerbach (1909, Fig. 2a). ×1350.

Fig. 10. A spore of *Leptotheca informis,* preserved in formol. After Auerbach (1910b, Fig. 1a). × about 2000.

Fig. 11. A spore of *Leptotheca longipes,* preserved in formol. After Auerbach (1910b, Fig. 1d). × about 2200.

Fig. 12. A fresh spore of *Leptotheca fusiformis.* After Davis (1917, Fig. 1). ×1500.

Fig. 13. Afresh spore of *Leptotheca scissura.* After Davis (1917, Fig. 8). ×1500.

Fig. 14. A fresh spore of *Leptotheca lobosa.* After Davis (1917, Fig. 11). ×1500.

Fig. 15. A fresh spore of *Leptotheca glomerosa.* After Davis (1917, Fig. 13). ×1500.

Fig. 16. A trophozoite of *Leptotheca* sp. After Awerinzew (1908, Pl. 2, Fig. 14). 1/12 and comp. oc. 12.

Fig. 17. Another trophozoite of the same. After Awerinzew (1908, Pl. 2, Fig. 17). 1/12 and comp. oc. 12.

Figs. 18 to 20. *Ceratomyxa arcuata.* After Thélohan (1895).

Figs. 18 and 19. Typical young form. After Thélohan (1895, Figs. 16 and 17).

Fig. 20. A trophozoite with two spores. After Thelohan (1895, Fig. 18).

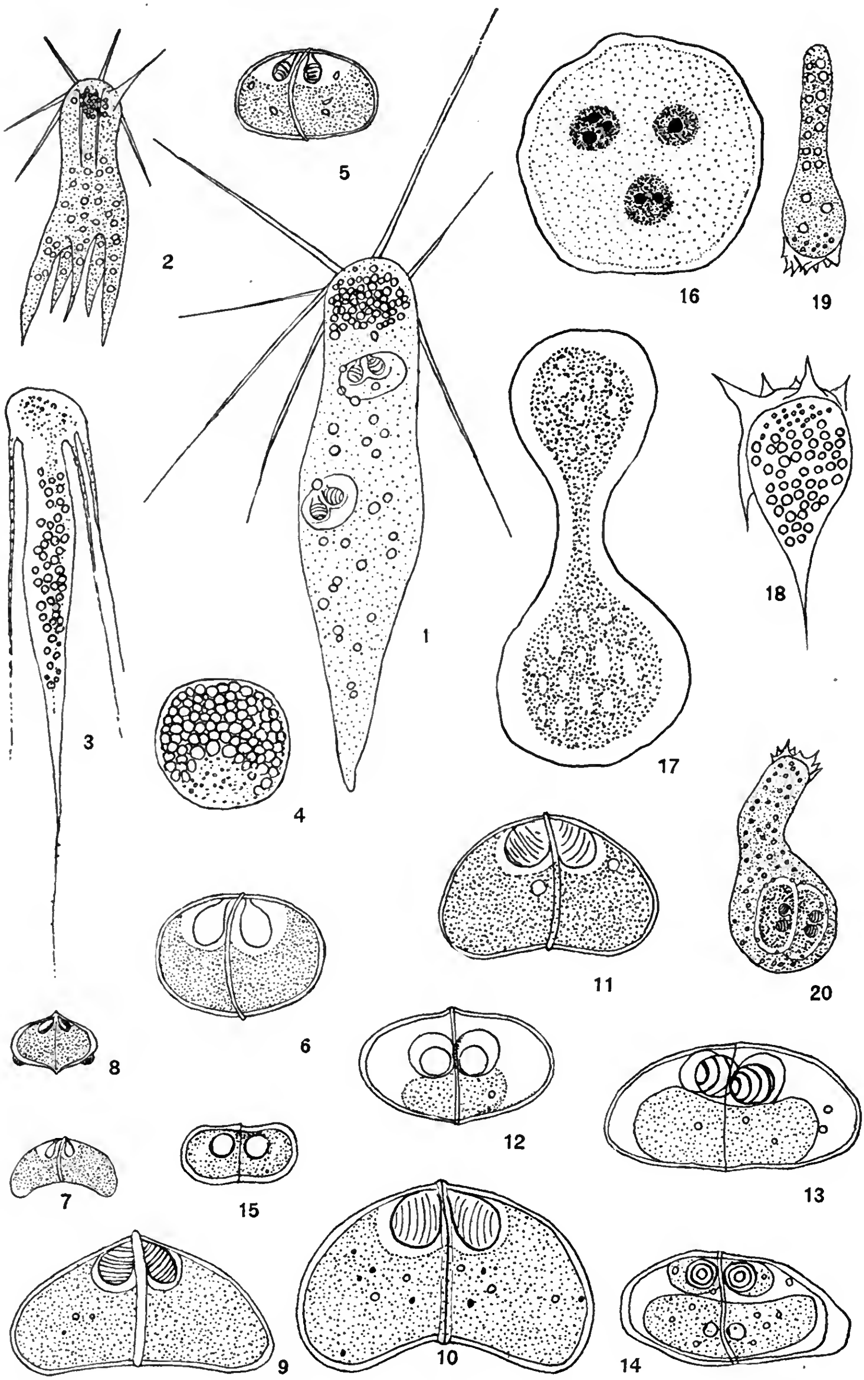
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PLATE II

EXPLANATION OF PLATE

Fig. 21. A sporulating trophozoite of *Ceratomyxa arcuata*. After Parisi (1912, Fig. 6a).
Fig. 22. A spore of *Ceratomyxa arcuata* treated with KOH. After Thélohan (1895, Fig. 19). ×1500.
Figs. 23 and 24. *Ceratomyxa sphaerulosa*. After Thélohan.
Fig. 23. A part of the tropzoite (1895, Fig. 2). ×750.
Fig. 24. A fresh spore (1895, Fig. 3). ×750.
Fig. 25. A fresh spore of *Ceratomyxa globulifera*. After Thélohan (1895, Fig. 43). ×1500.
Fig. 26. An adult trophozoite of *Ceratomyxa appendiculata*. After Thélohan (1895, Fig. 4). × about 400.
Fig. 27. A spore of *Ceratomyxa truncata*. After Thélohan (1895, Fig. 51). ×1500.
Fig. 28. A spore of *Ceratomyxa reticularis*. After Thélohan (1895, Fig. 27). ×1500.
Fig. 29. A spore of *Ceratomyxa inaequalis*. After Doflein (1898, Fig. 10). ×1250.
Figs. 30 and 31. *Ceratomyxa linospora*. After Doflein (1898). × about 1900.
Fig. 30. A spore (1898, Fig. 39).
Fig. 31. A trophozoite with spores (1898, Fig. 43).
Figs. 32 and 33. *Ceratomyxa ramosa*. After Awerinzew (1908).
Fig. 32. A trophozoite (1908, Pl. 2, Fig. 20). Zeiss obj. D and comp. oc. 4.
Fig. 33. A spore (1908, Pl. 2, Fig. 19). Zeiss obj. E and comp. oc. 4.

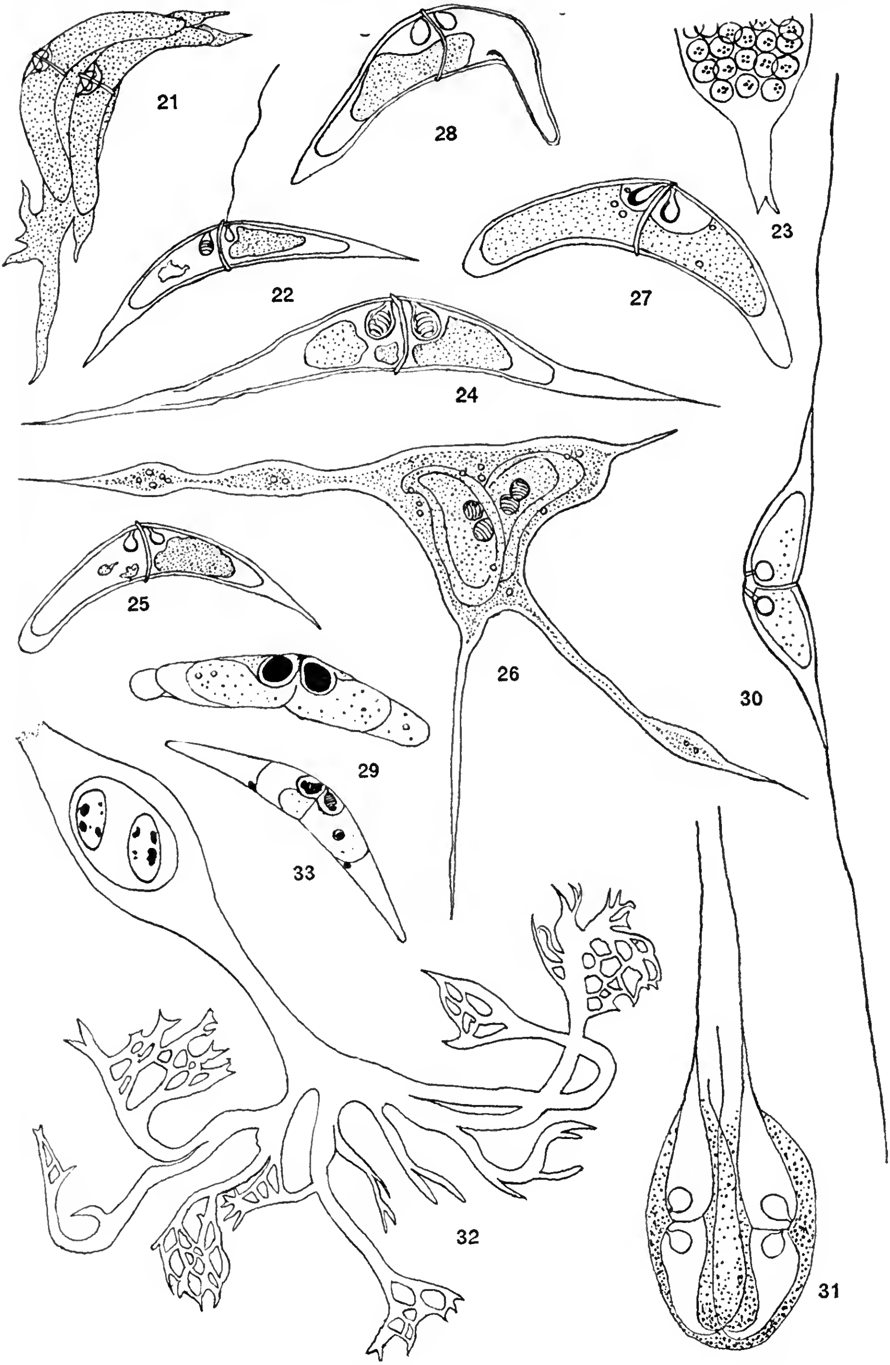
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PLATE III

EXPLANATION OF PLATE

Figs. 34 to 39. *Ceratomyxa drepanopsettae.* Awerinzew (1908).

Fig. 34 and 35. Trophozoites (1908, Pl. 2, Figs. 7 and 9). Obj. D and oc. 4.

Fig. 36. The part of a trophozoite attached to the epithelium of the gall-bladder of the host 1908, Pl. 2, Fig. 10). Obj. E and oc. 4.

Figs. 37 to 39. Spores (1908, Pl. 1, Figs. 2, 3 and 1). Obj. D and oc. 4.

Figs. 40 and 41. Two different views of the spore of *Ceratomyxa tylosuri.* After Awerinzew (1913a, Fig. 1). × about 350.

Figs. 42 and 43. *Ceratomyxa*(?) *spari.* After Awerinzew (1913a, Fig. 2).

Fig. 42. A trophozoite.

Fig. 43. A spore. × about 345.

Figs. 44 to 47. Spores of *Ceratomyxa acadiensis.* After Mavor (1916). Figs. 44 and 45 (1916, Fig. B). ×270. Fig. 46 (1916, Fig. A) ×1800. Fig. 47 (1916, Fig. 40) ×2950.

Fig. 48. A spore of *Ceratomyxa coris.* After Georgévitch (1916a, Fig. 1).

Fig. 49. A spore of *Ceratomyxa herouardi.* After Georgévitch (1917, Fig. 1).

Fig. 50. A spore of *Ceratomyxa mesospora.* After Davis (1917, Fig. 15). ×1500.

Fig. 51. A spore of *Ceratomyxa sphairophora.* After Davis (1917, Fig. 23). ×950.

Figs. 52 and 53. Spores of *Ceratomyxa taenia.* After Davis (1917, Figs. 26 and 25). ×700.

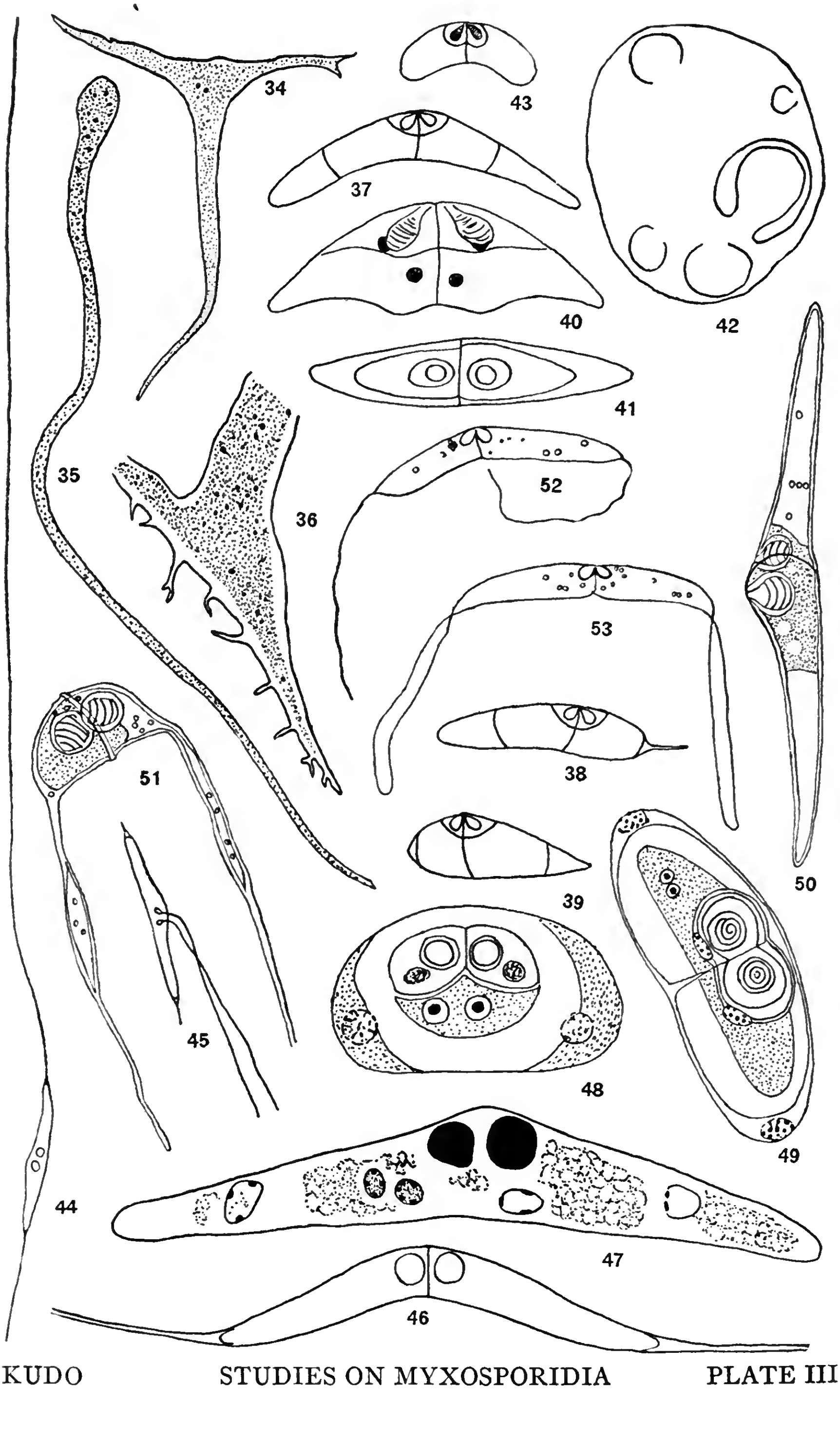
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PLATE IV

EXPLANATION OF PLATE

Fig. 54. A spore of *Ceratomyxa attenuata*. After Davis (1917, Fig. 28). ×950.

Figs. 55 and 56. Spores of *Ceratomyxa recurvata*. After Davis (1917, Figs. 32 and 33). ×1500.

Figs. 57 to 60. Spores of *Ceratomyxa lunata*. After Davis (1917, Figs. 34 to 37). ×1500.

Fig. 61. A spore of *Ceratomyxa abbreviata*. After Davis (1917, Fig. 41). ×1500.

Fig. 62. A spore of *Ceratomyxa flagellifera*. After Davis (1917, Fig. 42). ×1500.

Fig. 63. A spore of *Ceratomyxa agglomerata*. After Davis (1917, Fig. 45). ×1500.

Fig. 64. A spore of *Ceratomyxa amorpha*. After Davis (1917, Fig. 47). ×1500.

Figs. 65 to 67. Spores of *Ceratomyxa monospora*. After Davis (1917, Figs. 57, 56 and 55). ×1500.

Figs. 68 and 69. Spores of *Ceratomyxa streptospora*. After Davis (1917, Figs. 59 and 60). ×1500.

Fig. 70. A spore of *Ceratomyxa aggregata*. After Davis (1917, Fig. 63). ×1400.

Fig. 71. A spore of *Ceratomyxa undulata*. After Davis (1917, Fig. 66). ×1500.

Figs. 72 and 73. Spores of *Ceratomyxa navicularia*. After Davis (1917, Figs. 69 and 68). ×1500.

Fig. 74. A spore of *Ceratomyxa spinosa*. After Davis (1917, Fig. 72). ×1500.

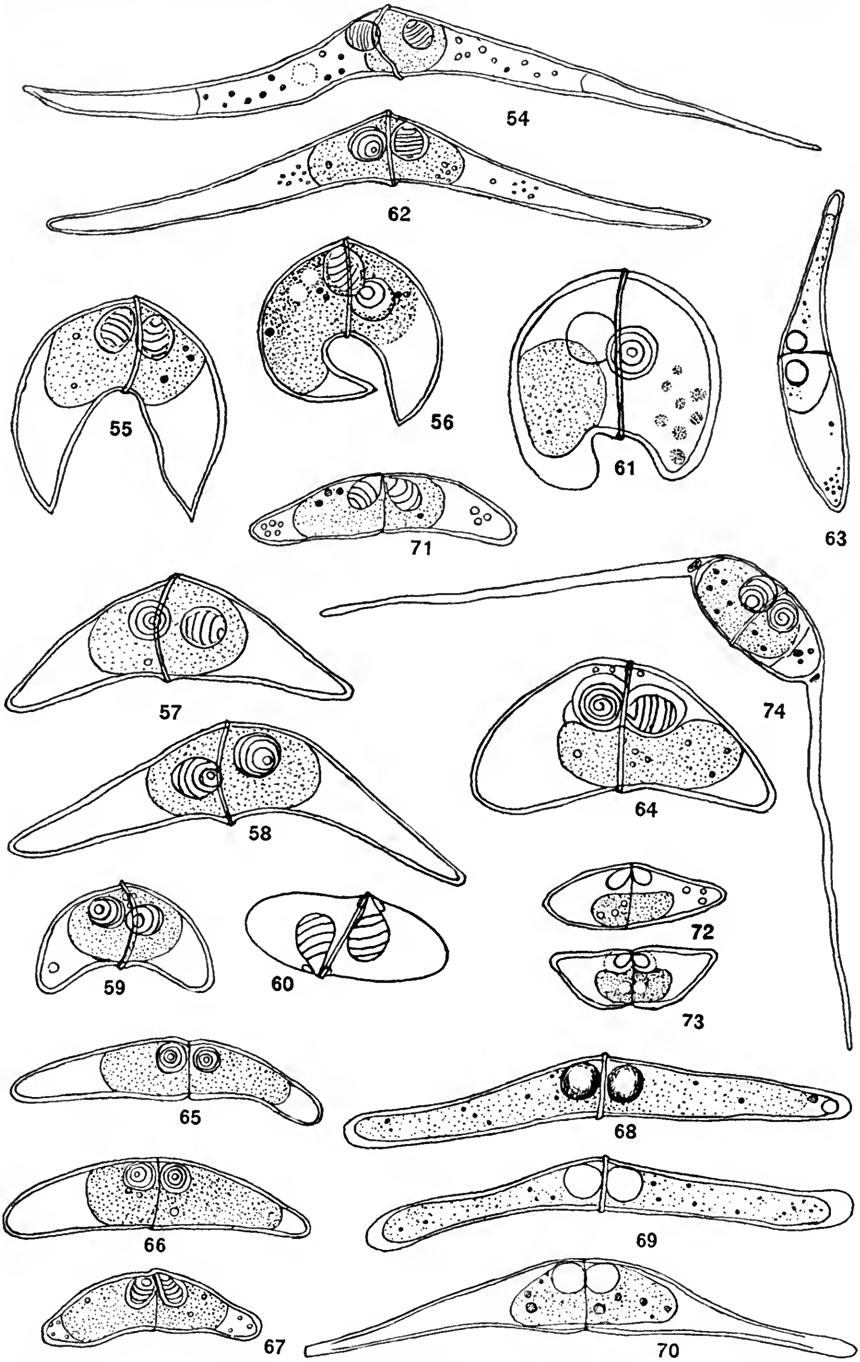
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PLATE V

EXPLANATION OF PLATE

Figs. 75 to 80. *Myxoproteus ambiguus*. After Doflein (1898).

Figs. 75 and 76. Trophozoites of typical forms (1898, Figs. 12 and 52).

Figs. 77 and 78. Young trophozoites produced by budding (1898, Figs. 55 and 56).

Figs. 79 and 80. Spores (1898, Figs. 54 and 64). × about 800 and 1080.

Figs. 81 to 83. Spores of *Myxoproteus cordiformis*. After Davis (1917, Figs. 79, 80 and 78). ×1500.

Fig. 84. A spore of *Myxoproteus cornutus*. After Davis (1917, Fig. 85). ×1400.

Figs. 85 to 95. *Wardia ovinocua*. Original.

Fig. 85. A portion of the cross-section thru an infected ovary of *Lepomis humilis*, showing the parasite in one ovum and the hypertrophied nurse cells and several connective tissue layers. × 160.

Fig. 86. A portion of the cross-section of a cyst. ×640.

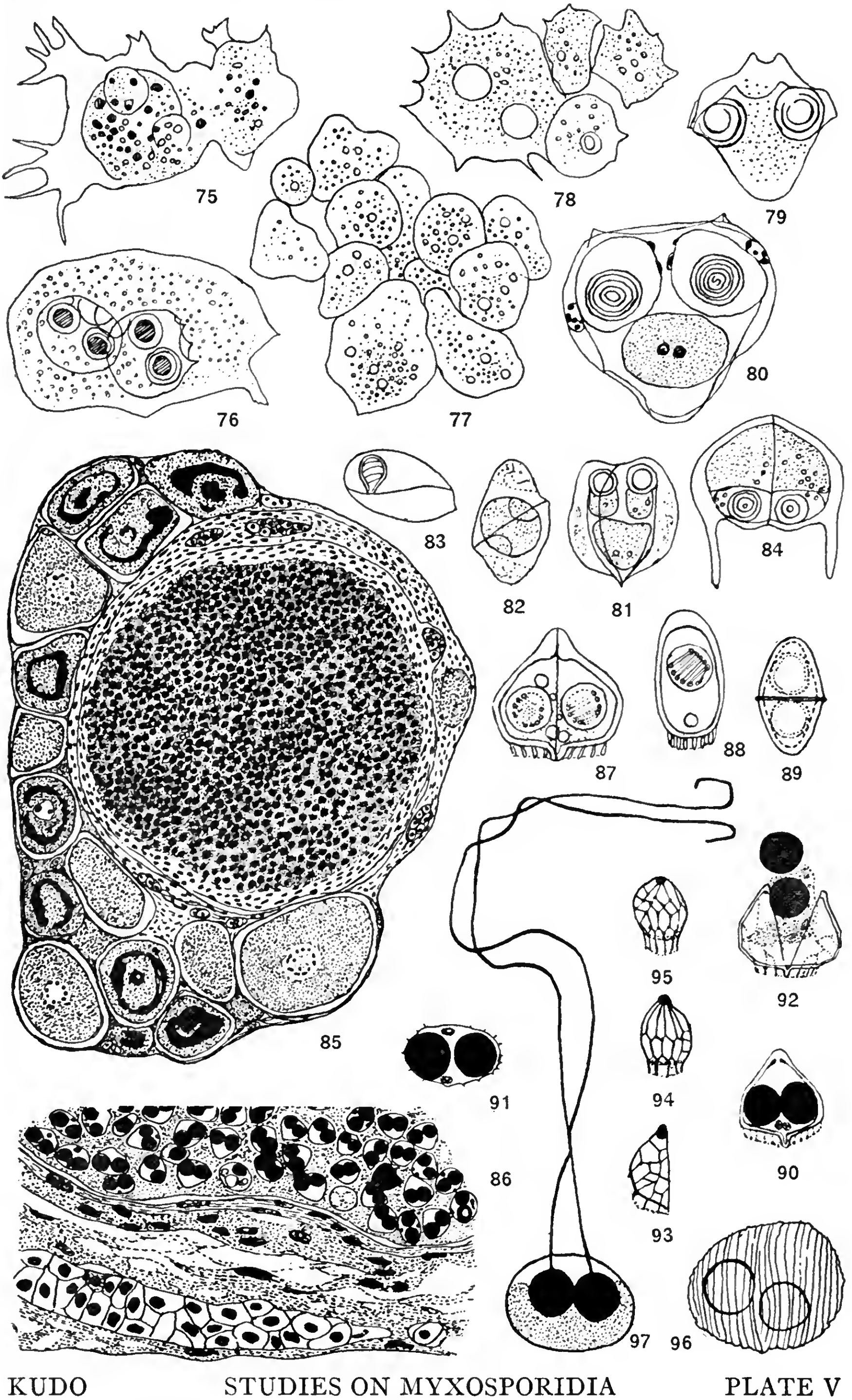
Figs. 87 to 89. Three different views of fresh spore. ×2000.

Figs. 90 and 91. Stained spores. ×1700.

Fig. 92. A spore mechanically pressed and stained with Giemsa's mixature, showing the escaping polar capsules without extruding polar filament, and the sporoplasm. ×1700.

Figs. 93 to 95. Front and lateral views of the shell valves, exhibiting the network-like fine ridges on the surface and the posterior processes. ×1700.

Figs. 96 and 97. Spores of *Wardia ohlmacheri*. After Ohlmacher (1893, Figs. 4a and 2). 2mm. and oc. 4.



KUDO STUDIES ON MYXOSPORIDIA PLATE V

PLATE VI

EXPLANATION OF PLATE

Figs. 98 to 104. *Mitraspora cyprini.*

Figs. 98 and 99. Trophozoites from the ureter of *Cyprinus carpio in vivo*. Original. × about 1500.

Figs. 100 and 101. Different views of fresh spores. Original. × about 2000.

Figs. 102 to 104. Spores. After Fujita (1912, Figs. 1a to 1c).

Figs. 105 to 107. *Mitraspora caudata.* After Parisi (1910 and 1913).

Fig. 105. A trophozoite (1910, Fig. 1).

Figs. 106 and 107. Front and lateral views of the spore (1913, Fig. 20 and 1910, Fig. 2). × about 1600.

Figs. 108 to 113. *Chloromyxum leydigi.*

Figs. 108 and 109. Trophozoites. After Thélohan (1895, Figs. 7 and 6). ×750.

Figs. 110 and 111. Trophozoites in division. After Doflein (1898, Figs. 57 and 58).

Figs. 112 and 113. Different views of spores. After Thélohan (1895, Figs. 10 and 9). ×1500.

Fig. 114. A spore of *Chloromyxum caudatum.* After Thélohan (1895, Fig. 36). ×1500.

Figs. 115 and 116. Different views of the spore of *Chloromyxum quadratum.* After Thélohan (1895, Figs. 100a and 100b). ×1500.

Fig. 117. A spore of *Chloromyxum quadratum* treated with nitric acid. After Thélohan (1895, Fig. 100c). ×1500.

Fig. 118. A spore of *Chloromyxum fluviatile.* After Thélohan (1892, Fig. 2). ×1500.

Figs. 119 and 120. Different views of the spore of *Chloromyxum mucronatum.* After Lieberkühn from Gurley (1894, Pl. 39, Fig. 5). × about 1750.

Figs. 121 and 122. The same after Balbiani (1884, Fig. 41). × about 1200.

Figs. 123 and 125. Spores of *Chloromyxum diploxys.* After Balbiani from Gurley (1894 Pl. 42, Figs. 13a, 13b and 13c).

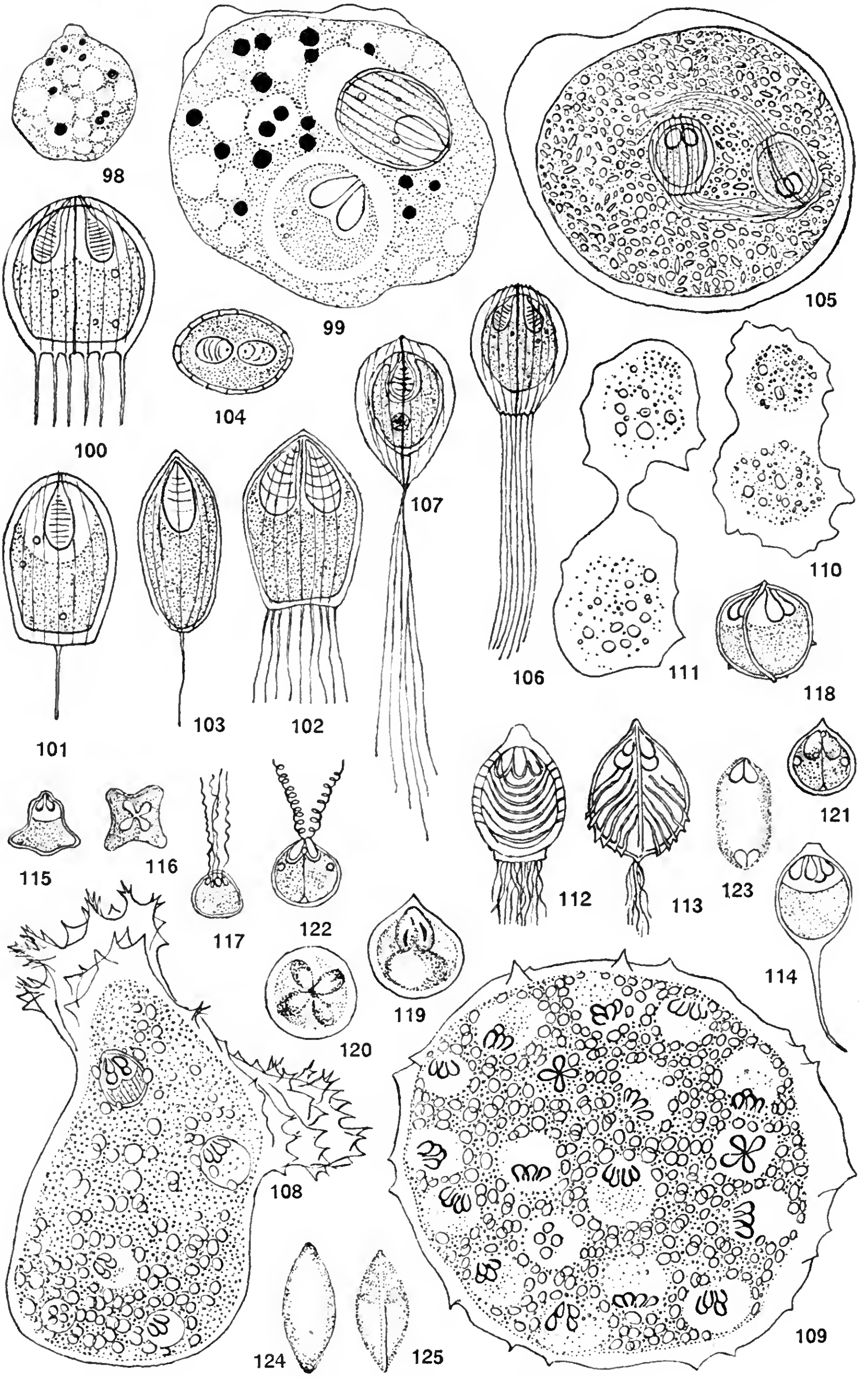

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PLATE VII

EXPLANATION OF PLATE

Fig. 126. Trophozoite of *Chloromyxum truttae.* After Léger (1906, Fig. 4). ×1000.

Figs. 127 and 128. Trophozoites of *Chloromyxum cristatum.* After Léger (1906, Fig. 7). ×1000.

Figs. 129 to 133. *Chloromyxum dubium.* After Auerbach (1908).

Figs. 129 and 130. Trophozoites (1908, Figs. 2 and 1).

Figs. 131 and 132. Spores (1908, Figs. 3 and 4). × about 2250.

Fig. 133. A stained young spore (1908, Fig. 5).

Fig. 134. Trophozoite of *Chloromyxum* sp. After Awerinzew (1908, Pl. 2: Fig. 12). Objective D and ocular 4.

Fig. 135. *Chloromyxum koi.* After Fujita (1913). × about 800.

Figs. 136 to 138. *Chloromyxum magnum.* After Awerinzew (1913a, Fig. 4).

Figs. 136 and 137. Trophozoites.

Fig. 138. A spore. × about 320.

Figs. 139 and 140. Spores of *Chloromyxum funduli.* After Hahn (1915, Figs. 34 and 33). ×2000.

Figs. 141 to 146. *Chloromyxum misgurni.* After Kudo (1916). ×1750.

Figs. 141 and 142. Trophozoites (1916, Figs. 3f and 3g)

Figs. 143 to 145. Different views of fresh spore (1916, Figs. 3a, 3c and 3b).

Fig. 146. A spore treated with potassium hydrate (1916, Fig. 3e).

Figs. 147 to 152. *Chloromyxum fujitai.* After Kudo (1916). ×1750.

Fig. 147. A trophozoite (1916, Fig. 4a).

Fig. 148. A fresh spore (1916, Fig. 4e).

Fig. 149. A spore stained with Giemsa's mixture (1916, Fig. 4g).

Figs. 150 to 152. Two surface views and an optical cross-section of a stained spore, showing the ridges on the shell valves (1916, Figs. 4b, 4d and 4c).

Figs. 153 to 156. Spores of *Chloromyxum clupeidae.*

Figs. 153 to 155. Fresh spores. After Linton (1901, Fig. 3). "Variously magnified."

Fig. 156. A spore. After Hahn (1917b, Fig. 10). ×1650.

Figs. 157 and 158. Two views of *Chloromyxum granulosum.* After Davis (1917, Figs. 137 and 138). ×1500.

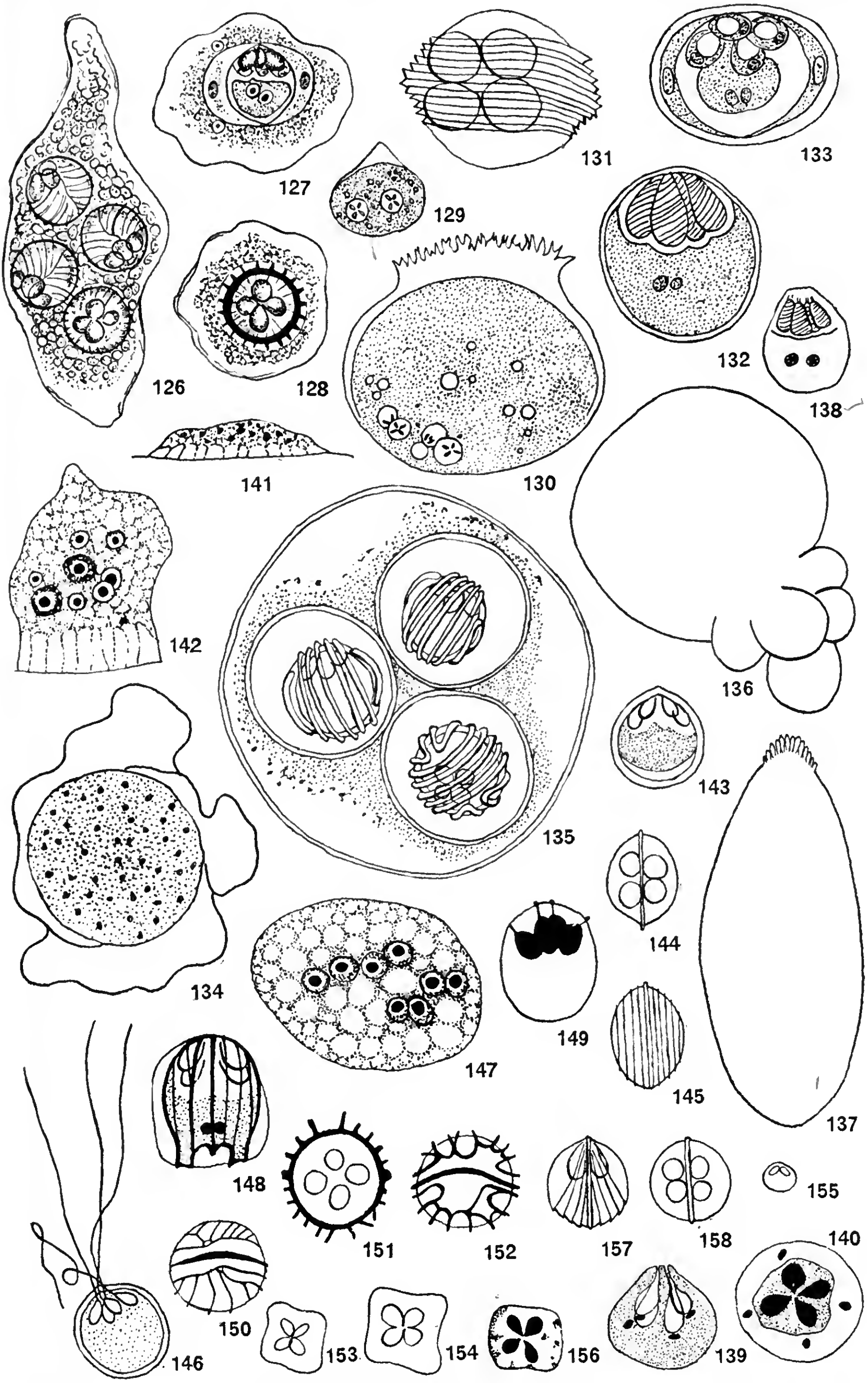
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PLATE VIII

EXPLANATION OF PLATE

Figs. 159 to 182. *Chloromyxum trijugum.* Original.

Figs. 159 to 174. Trophozoites of various form and age.

Figs. 159 and 160. Trophozoites of medium size. ×640.

Fig. 161. A trophozoite, ten minutes after it was removed from the host. ×1700.

Figs. 162 and 163. The movements of pseudopodia of the same specimen in ten minutes. ×1700.

Fig. 164. The same specimen after thirty minutes. ×1700.

Figs. 165 to 167. A trophozoite, showing the change of pseudopodia in five and ten minutes. ×1700.

Figs. 168 to 172. Small trophozoite with different numbers of the nuclei. Fig. 172 is probably a disporous form. ×2350.

Fig. 173. A monosporous trophozoite with a young spore. ×2350.

Fig. 174. A young spore. ×2350.

Figs. 175 to 177. Different views of fresh spores. ×1700.

Fig. 178. A Giemsa stained spore. ×1700.

Figs 179 and 180. Side views of the valves showing the ridges by Giemsa staining. ×1700.

Fig. 181. A spore treated with potassium hydrate solution, and stained with Giemsa solution. ×1700.

Fig. 182. A spore from which the sporoplasm is leaving the shell. From the Giemsa smear of the infected bile. ×1700.

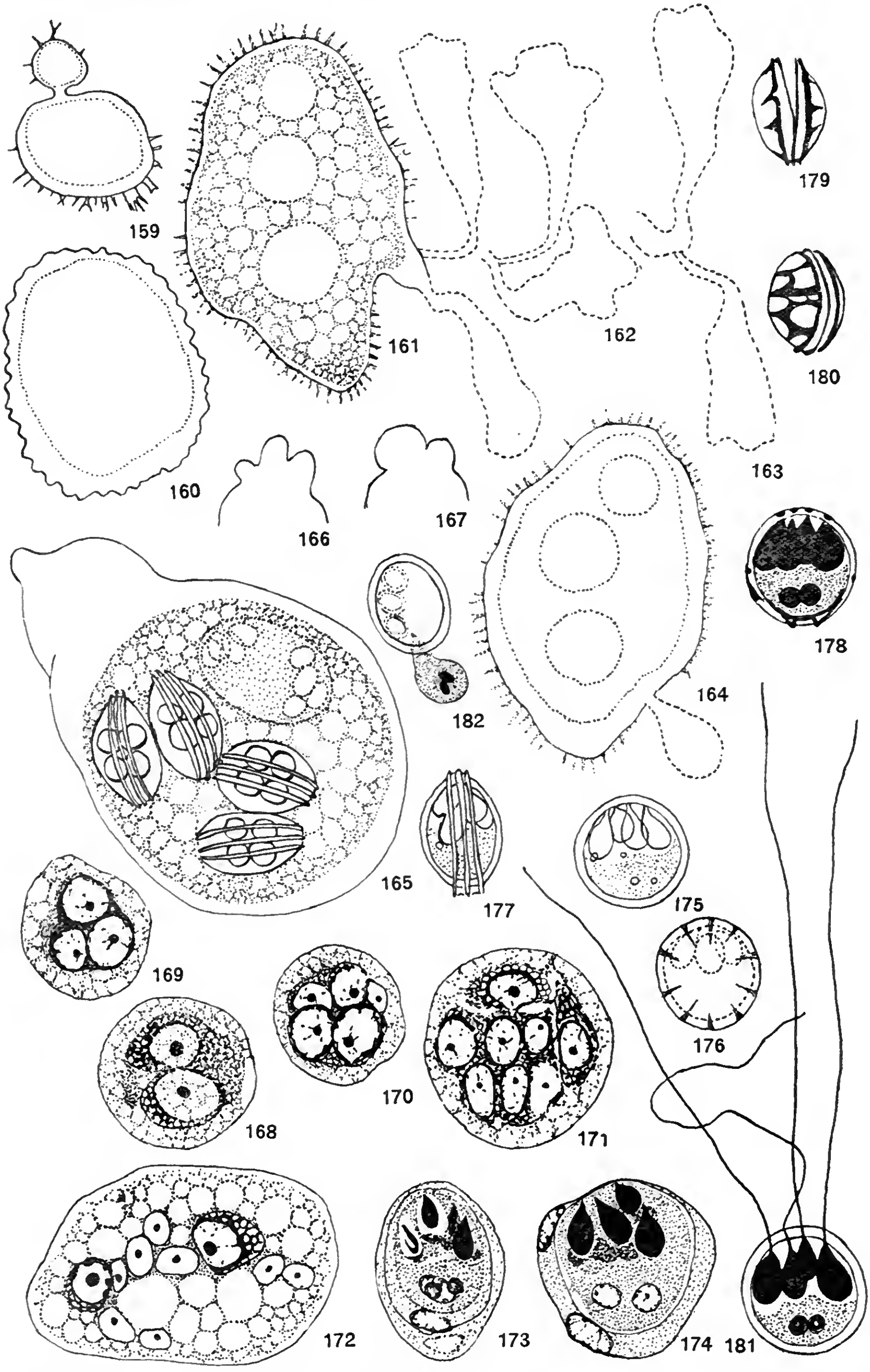
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PLATE IX

EXPLANATION OF PLATE

Fig. 183 to 186. *Sphaerospora divergens.*

Fig. 183. Trophozoite. After Thélohan (1895, Fig. 12). ×750.

Figs. 184 and 185. Two views of spore. After Auerbach (1912, Pl. 5, Fig. 4). × about 1500.

Fig. 186. A spore treated with nitric acid. After Thélohan (1895, Fig. 13). ×1500.

Figs. 187 and 88. Spores of *Sphaerospora elegans.* After Thélohan (1890b, Fig. 1). × about 1000.

Fig. 189. A spore of *Sphaerospora rostrata.* After Thélohan (1895, Fig. 93). ×about 1635.

Figs. 190 to 192. Spores of *Sphaerospora masovica.* After Cohn (1902, Fig. 3). ×1000.

Fig. 192. Spore with extruded polar filaments and "starren Fäden" by warming.

Figs. 193 and 194. Spores of *Sphaerospora platessae.* After Woodcock (1904, Fig. 7d). ×900.

Figs. 195 to 197. Spores of *Sphaerospora angulata.* After Fujita (1912, Fig. 3). × about 2800.

Figs. 198 and 199. Spores of *Sphaerospora polymorpha.* After Davis (1917, Figs. 91 and 92) ×1500.

Figs. 200 to 204. *Sphaerospora carassii.* Original.

Fig. 200. A trophozoite. ×2250.

Figs. 201 to 203. Different views of spores. ×1800.

Fig. 204. A young spore. ×2250.

Figs. 205 to 209. *Sinuolinea dimorpha.* After Davis (1916).

Fig. 205. A fresh trophozoite (1916, Fig. 1). ×1400.

Figs. 206 and 207. Trophozoites with erythrocytes in different stages of disintegration (1916, Figs. 2 and 57). ×640.

Fig. 208. A stained disporous trophozoite (1916, Fig. 41).

Fig. 209. A stained gemmule (1916, Fig. 72).

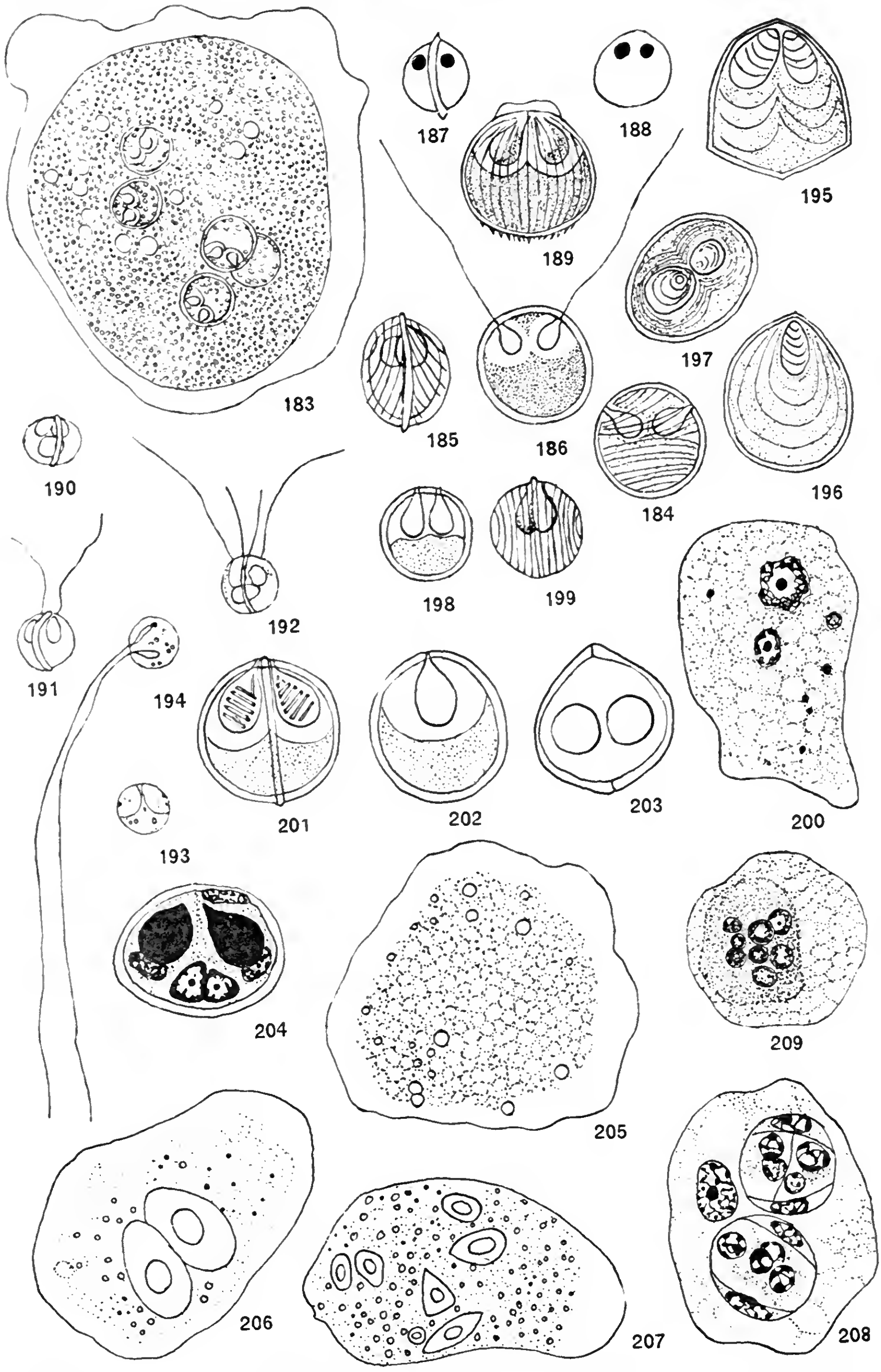
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PLATE X

EXPLANATION OF PLATE

Figs. 210 to 213. *Sinuolinea dimorpha.* After Davis (1916 and 1917).
Fig. 210. A living trophozoite (1916, Fig. 56). ×640.
Fig. 211. A living trophozoite from which a gemmule is just escaping (1916, Fig. 60). ×640.
Figs. 212 and 213. Spores (1917, Figs. 99 and 100). ×1400.
Figs. 214 to 216. Spores of *Sinuolinea capsularis.* After Davis (1917, Figs. 105 to 107). ×1500.
Figs. 217 and 218. Spores of *Sinuolinea arborescens.* After Davis (1917, Figs. 109 to 110). ×1500.
Fig. 219. Spore of *Sinuolinea opacita.* After Davis (1917, Fig. 112). ×1500.
Fig. 220. Spore of *Sinuolinea brachiophora.* After Davis (1917, Fig. 113). ×1500.
Figs. 221 to 224. *Myxidium lieberkühni.* After Bütschli (1881 and 1882).
Fig. 221. A trophozoite (1882, Pl. 38, Fig. 12). × about 60.
Fig. 222. A trophozoite (1882, Pl. 38, Fig. 13). ×160.
Figs. 223 and 224. Trophozoites (1881, Figs. 27 and 26).

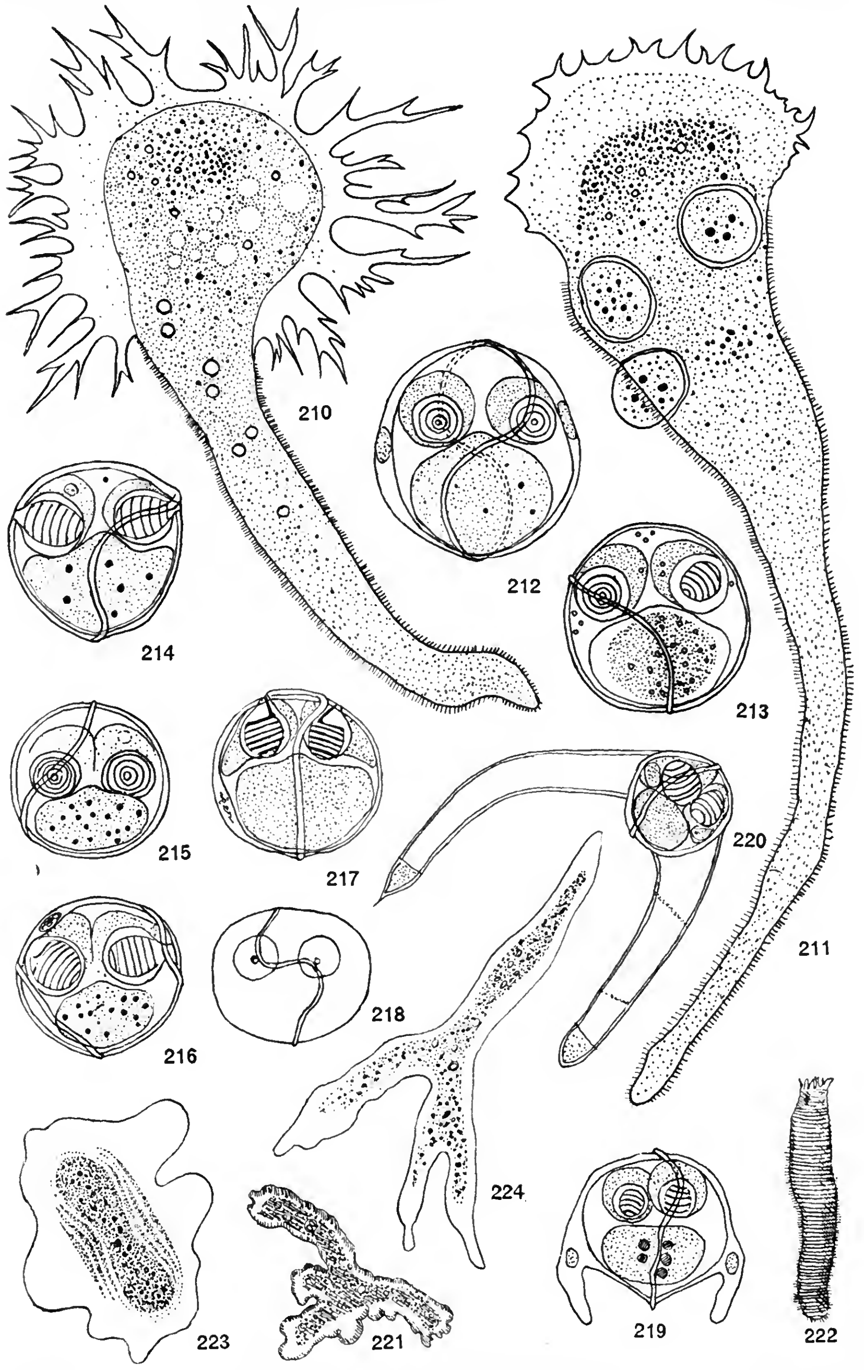
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PLATE XI

EXPLANATION OF PLATE

Figs. 225 to 240. *Myxidium lieberkühni.*

Fig. 225. A trophozoite. After Lieberkühn from Gurley (1894, Pl. 43, Fig. 1a). ×330.

Figs. 226 and 227. Trophozoites. After Bütschli (1881, Figs. 25 and 31).

Figs. 228 to 230. Stained trophozoites. After Thélohan (1895, Figs. 44, 46 and 45). ×750.

Fig. 231. A trophozoite forming daughter individuals by budding. After Cohn (1895 Fig. 5).

Fig. 232. Four figures showing the separation of a bud. After Cohn (1895, Figs. 6a, 6b, 6d and 6e).

Fig. 233. A cross-section of a trophozoite, showing the ectoplasm, mesoplasm and endoplasm. After Cohn (1895, Fig. 2).

Fig. 234. A trophozoite. After Laveran and Mesnil (1902, Fig. 3). ×500.

Fig. 235. A part of a trophozoite. After Laveran and Mesnil (1902, Fig. 3). ×800.

Figs. 236 and 237. Young trophozoites undergoing division. After Laveran and Mesnil (1902, Figs. 4 and 5). ×1000.

Fig. 238. An isolated spore. After Bütschli (1881, Fig. 32). × about 2500.

Figs. 239 and 240. Fresh and stained spores. After Thélohan (1895, Figs. 47 and 48). ×1500.

Figs. 241 to 251. *Myxidium incurvatum.*

Fig. 241. A monosporous trophozoite. After Parisi (1912, Fig. 1).

Fig. 242. A spore. After Thélohan (1895, Fig. 54). ×1500.

Figs. 243 and 244. Different views of spore. After Parisi (1912, Fig. 1).

Fig. 245. A young spore. After Georgévitch (1916, Fig. 11).

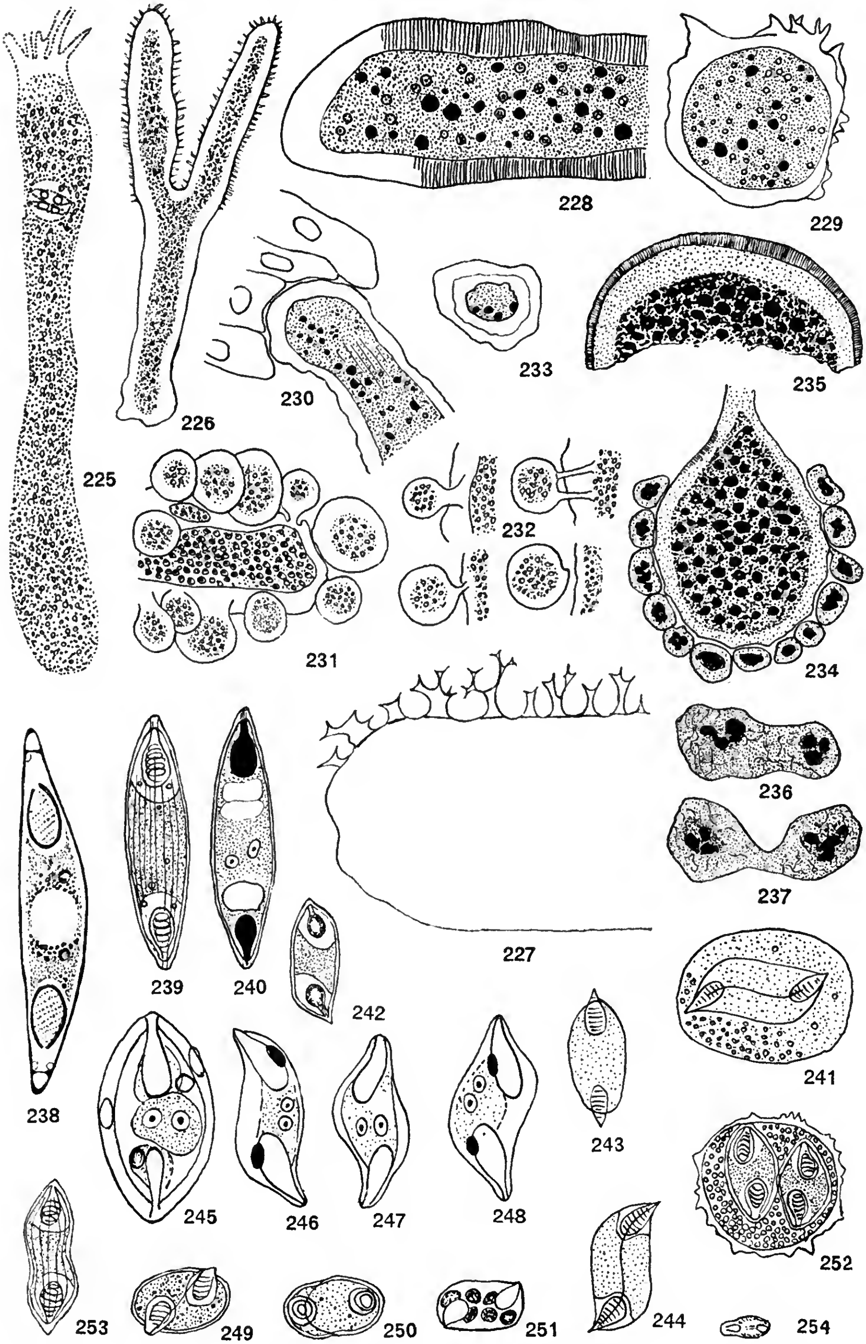
Figs. 246 to 248. Spores. After Georgévitch (1916, Figs. 10, 9 and 8).

Figs. 249 to 251. Spores. After Davis (1917, Figs. 119 to 121). ×1500.

Fig. 252. Trophozoite of *Myxidium sphaericum.* After Thélohan (1895, Fig. 28). ×1500.

Fig. 253. A spore of *Myxidium histophilum.* After Thélohan (1895, Fig. 49). ×1500.

Fig. 254. A spore of *Myxidium* sp. After Leydig from Gurley (1894, Pl. 47, Fig. 6).



KUDO STUDIES ON MYXOSPORIDIA PLATE XI

PLATE XII

EXPLANATION OF PLATE

Figs. 255 to 257. *Myxidium danilewskyi*. After Laveran (1898).

Figs. 255 and 256. Longitudinal and transverse sections thru renal tubules, showing the trophozoites (1898, Figs. 1 and 2). Fig. 255. ×350.

Fig. 257. Spores (1898, Figs. 4, 5 and 6). ×800.

Fig. 258. Spores of *Myxidium giganteum*. After Doflein (1898, Fig. 48). × about 500.

Figs. 259 to 261. Spores of *Myxidium giardi*. After Cépède (1906a, Figs. 1, 3 and 2). ×2000.

Figs. 262 to 265. Spores of *Myxidium pfeifferi*. After Auerbach (1908, Figs. 6 and 7). × about 2000, except Fig. 265.

Fig. 266. A spore of *Myxidium inflatum*. After Auerbach (1909, Fig. 3a). × about 1500.

Fig. 267. A spore of *Myxidium bergense*. After Auerbach (1910a, Fig. 57). × about 1820.

Fig. 268. A spore of *Myxidium procerum*. After Auerbach (1910a, Fig. 58). × about 2000.

Figs. 269 to 271. Spores of *Myxidium mackiei*. After Bosanquet (1910, Fig. 12). × about 1250.

Figs. 272 and 273. Spores of *Myxidium macrocapsulare*. After Auerbach (1910d, Figs. 1a and 1b). ×3000.

Figs. 274 to 276. *Myxidium* sp. After Awerinzew (1908 and 1911).

Fig. 274. A monosporous trophozoite (1911, Fig. C).

Fig. 275. A disprous trophozoite (1908, Pl. 2, Fig. 6). Obj. E and oc. 4.

Fig. 276. A spore (1908, Pl. 1a, Fig. 17). × about 1000.

Figs. 277 and 278. Spores of *Myxidium depressum*. After Parisi (1912, Figs. 2a and 2b). × about 1600.

Figs. 279 and 280. Spores of *Myxidium oviforme*. After Parisi (1912, Fig. 3). × about 1600.

Figs. 281 to 284. Spores of *Myxidium anguillae*. After Ishii (1915, Fig. 3a). ×1450.

Figs. 285 and 286. *Myxidium* sp. After Mavor (1915).

Fig. 285. A spore treated with ammonia water (1915, Fig. 3a). ×660.

Fig. 286. A spore (1915, Fig. 3b). ×1320.

Figs. 287 to 290. Spores of *Myxidium gadi*. After Georgévitch (1916, Figs. 1, 4, 3 and 2).

Fig. 228. A spore from *Solea vulgaris*.

Figs. 289 and 290. Young spores.

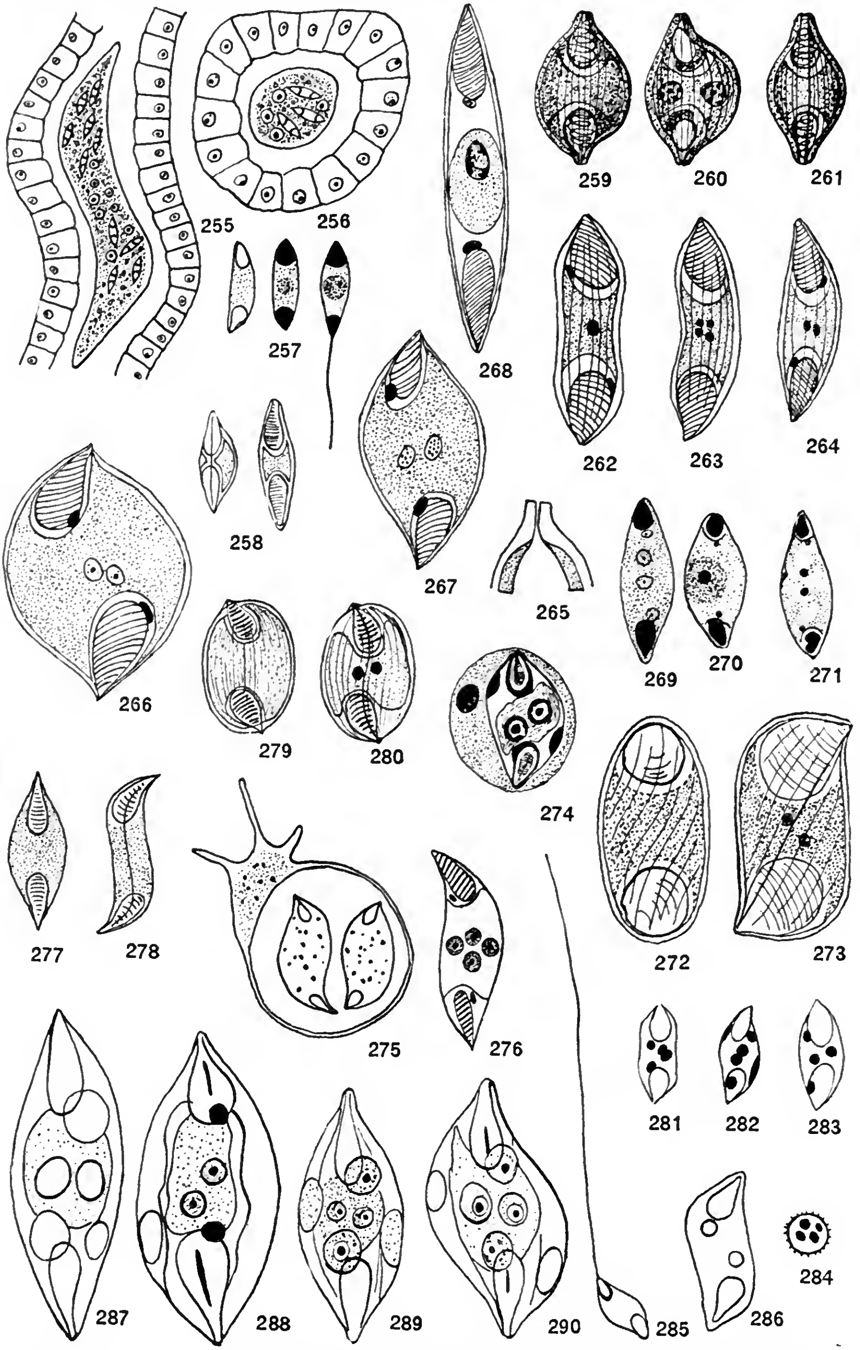

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PLATE XIII

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Fig. 291. A spore of *Myxidium glutinosum*. After Davis (1917, Fig. 124). ×1400.

Figs. 292 and 293. Spores of *Myxidium phyllium*. After Davis (1917, Figs. 126 and 127). ×2000.

Figs. 294 and 295. Spores of *Myxidium kagayamai*. After Kudo (1916, Fig. 2). ×1750 and ×1000 respectively.

Figs. 296 to 307. *Sphaeromyxa balbianii*.

Fig. 296. A trophozoite. After Thélohan (1895, Fig. 57). ×3.

Fig. 297. A trophozoite. After Davis (1917, Fig. 128). ×640.

Fig. 298. A trophozoite in plasmotomy. After Georgévitch (1916, Fig. 15).

Figs. 299 and 300. Spores. After Thélohan (1895, Figs. 58 and 59). ×1500.

Fig. 301. An end of a spore. After Thélohan (1895, Fig. 60).

Fig. 302. A spore treated with nitric acid. After Thélohan (1895, Fig. 61).

Fig. 303. A spore. After Parisi (1912, Fig. 4). × about 1750.

Fig. 304. A spore. After Davis (1917, Fig. 130). ×2100.

Figs. 305 to 307. Mature and young spores (Figs. 306 and 307). After Georgévitch (1916, Figs. 17, 20 and 19).

Figs. 308 to 311. *Sphaeromyxa immersa*. After Lutz (1889: 301).

Fig. 308. An infected gall-bladder of *Bufo aqua* (1889, Fig. 1). ×1.

Fig. 309. Spores (1889, Figs. 4, 5 and 6).

Fig. 310. A spore (1889, Fig. 10). ×600.

Fig. 311. A spore with extruded polar filaments (1889, Fig. 7).

Figs. 312 to 314. Spores of *Sphaeromyxa incurvata*. After Doflein (1898, Fig. 49). × about 1000.

Figs. 315 and 316. *Sphaeromyxa sabrazesi*. After Schröder (1907).

Fig. 315. A trophozoite (1907, Fig. 1). ×15.

Fig. 316. A cross section thru a trophozoite (1907, Fig. 3). ×1500.

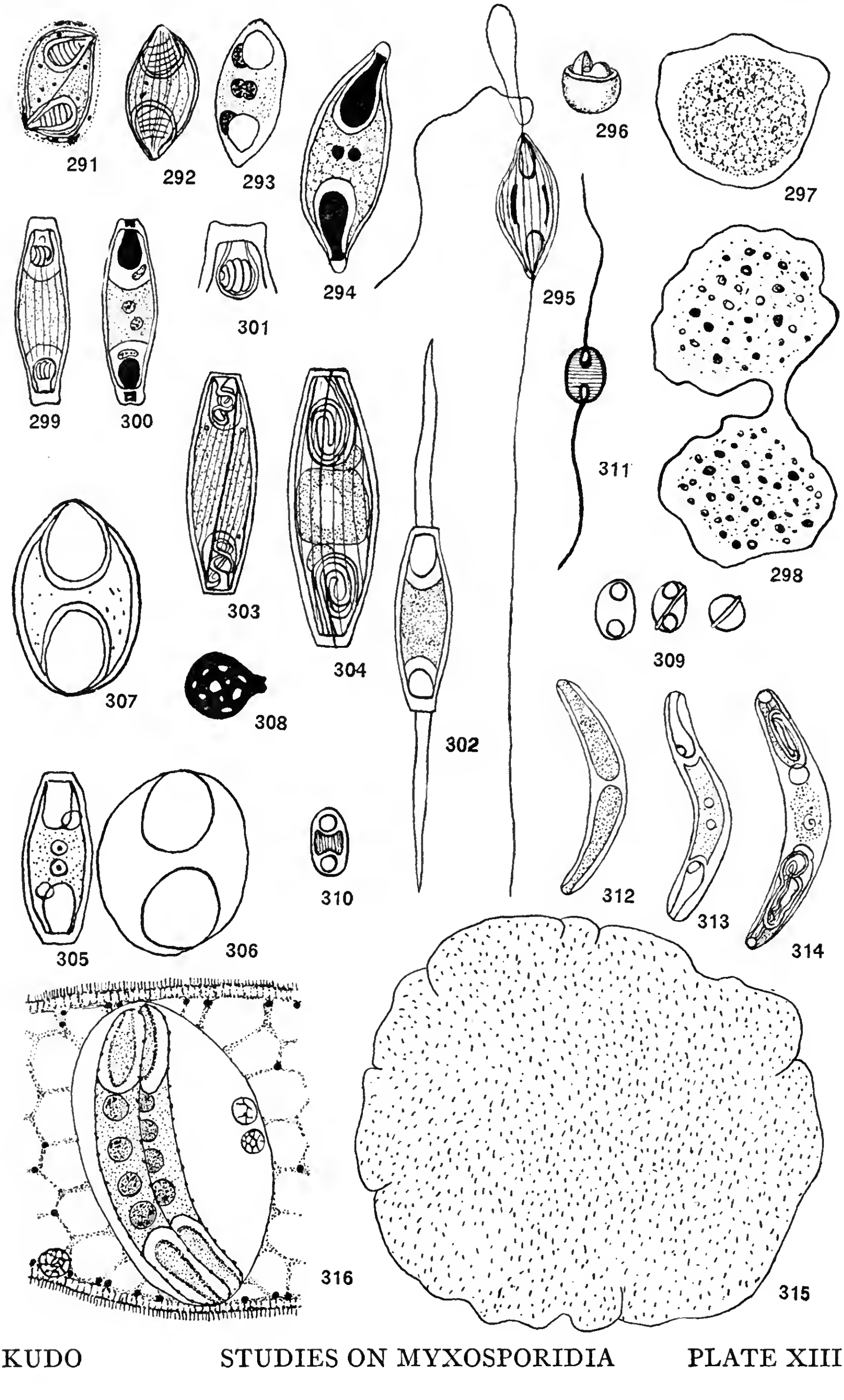
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PLATE XIV

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Figs. 317 to 322. Spores of *Sphaeromyxa sabrazesi*.
Figs. 317 to 319. After Laveran and Mesnil (1900, Figs. 1, 3 and 4). ×1500.
Fig. 318. A spore treated with nitric acid (1900, Fig. 3).
Figs. 320 and 321. Spores. After Schröder (1907, Figs. 39 and 41). ×1500.
Fig. 322. A polar capsule. After Schröder (1907, Fig. 45).
Figs. 323 and 324. Spores of *Sphaeromyxa hellandi*. After Auerbach (1909, Fig. 5). × about 1500.
Figs. 325 and 326. Spores of *Sphaeromyxa exneri*. After Awerinzew (1913a, Fig. 3). × about 365.
Fig. 327. A spore of *Sphaeromyxa gasterostei*. After Georgévitch (1916, Fig. 22).
Figs. 328 to 331. *Zschokkella hildae*. After Auerbach (1910a and 1912).
Fig. 328. A monosporous trophozoite (1912, Pl. 5, Fig. 2).
Figs. 329 to 331. Spores (1910a, Fig. 62).
Figs. 332 and 333. Spores of *Zschokkella nova*. After Klokacewa (1914, Fig. 2). × about 2500.
Figs. 334 to 338. Spores of *Zschokkella acheilognathi*. After Kudo (1916).
Figs. 334 to 336. Different views of fresh spores (1916, Figs. 3d, 3e and 3f). ×2250.
Fig. 337. A young spore. Original. ×2785.
Fig. 338. A stained spore (1916, Fig. 3h). ×2800.
Figs. 339 and 340. Spores of *Zschokkella globulosa*. After Davis (1917, Figs. 135 and 134). ×1500.
Figs. 341 to 343. Spores of *Myxosoma dujardini*. After Thélohan (1895, Figs. 90, 91, and 89). ×1500.
Figs. 344 to 347. Spores of *Myxosoma funduli*. After Kudo (1918a, Fig. A). ×1500.

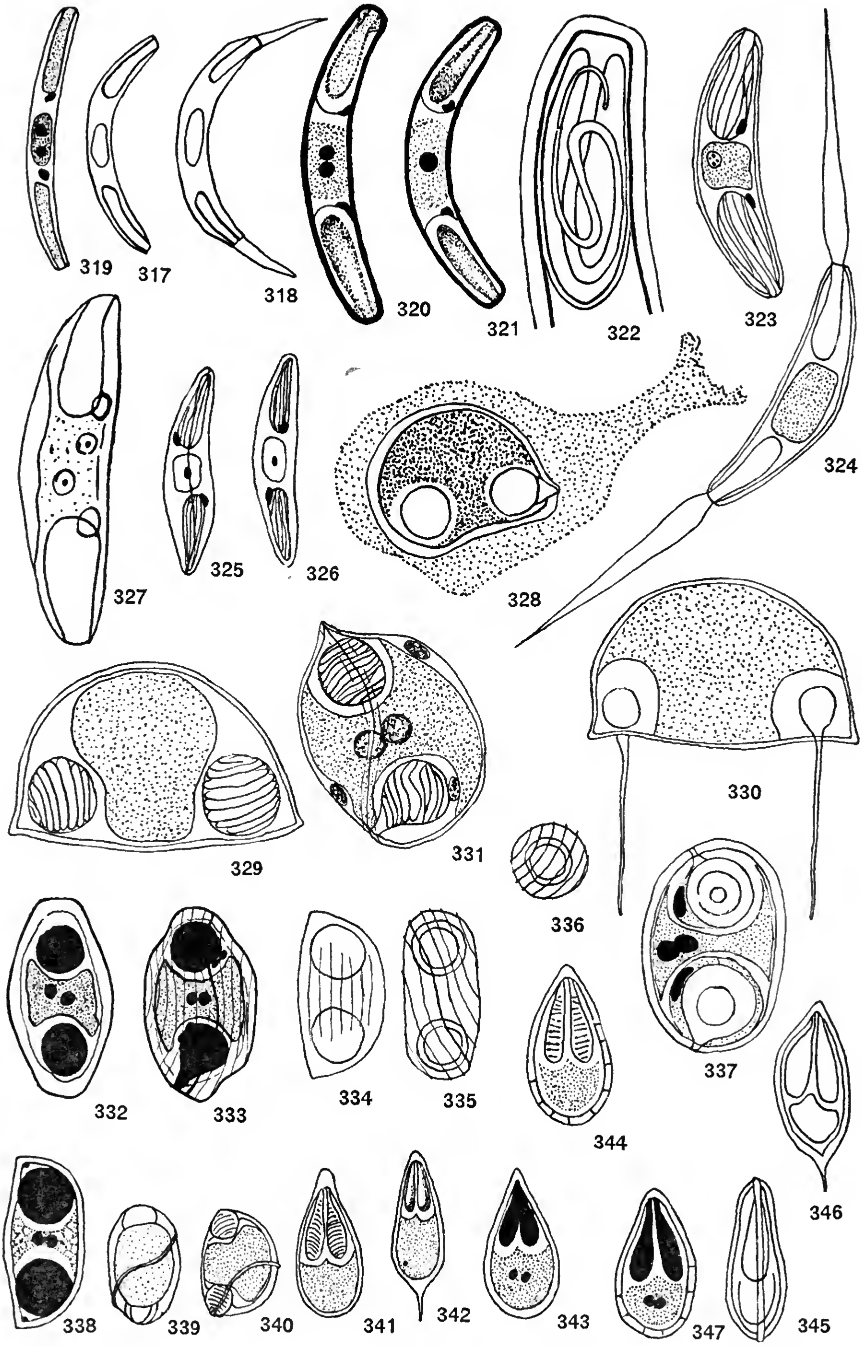
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PLATE XV

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Fig. 348. A spore of *Myxosoma*(?) *lobatum*. After Nemeczek (1911, Fig. 18). ×1000.
Fig. 349 to 354. *Lentospora cerebralis*. After Plehn (1905). ×1200.
Fig. 349. Various young ameboid forms; stained (1905, Textfig. 5).
Fig. 350. A stained larger form (1905, Textfig. 5).
Fig. 351. A trophozoite with two spores (1905, Textfig. 4).
Fig. 352. Various spores (1905, Textfig. 2).
Fig. 353. A stained spore (1905, Textfig. 3).
Fig. 354. A spore with extruded polar filaments (1905, Textfig. 2).
Fig. 355. A spore of *Lentospora multiplicata*. After Reuss (1906, Fig. 8). ×1500.
Figs. 356 to 359. Spores of *Lentospora asymmetrica*. After Parisi (1912, Fig. 7). × about 1500.
Figs. 360 to 362. Spores of *Lentospora acuta*. After Fujita (1912, Fig. 2). ×2000.
Figs. 363 and 364. Spores of *Myxobolus piriformis*. After Thélohan (1895, Figs. 117 and 116). ×1500.
Figs. 365 and 366. Spores of *Myxobolus unicapsulatus*. After Müller (1841, Fig. 5).
Fig. 367. A spore of *Myxobolus fuhrmanni*. After Auerbach (1909, Fig. 1b). ×1840.
Fig. 368. A spore of *Myxobolus oculi-leucisci*. After Trojan (1909, Fig. 3). ×2000.
Figs. 369 and 370. Spores of *Myxobolus toyamai*. After Kudo (Original and 1917, Fig. 40). ×2500.
Figs. 371 and 372. Spores of *Myxobolus notatus*. After Mavor (1916, Figs. 6C and 6B). ×2600.
Figs. 373 and 374. Spores of *Myxobolus rohitae*. After Southwell and Prashad (1918, Figs. 26 and 27). × about 1720 and 700 respectively.
Figs. 375 and 376. Spores of *Myxobolus seni*. After Southwell and Prashad (1918, Figs. 29 and 30). × about 1700.
Figs. 377 and 378. Spores of *Myxobolus misgurni*. Original. ×1500.

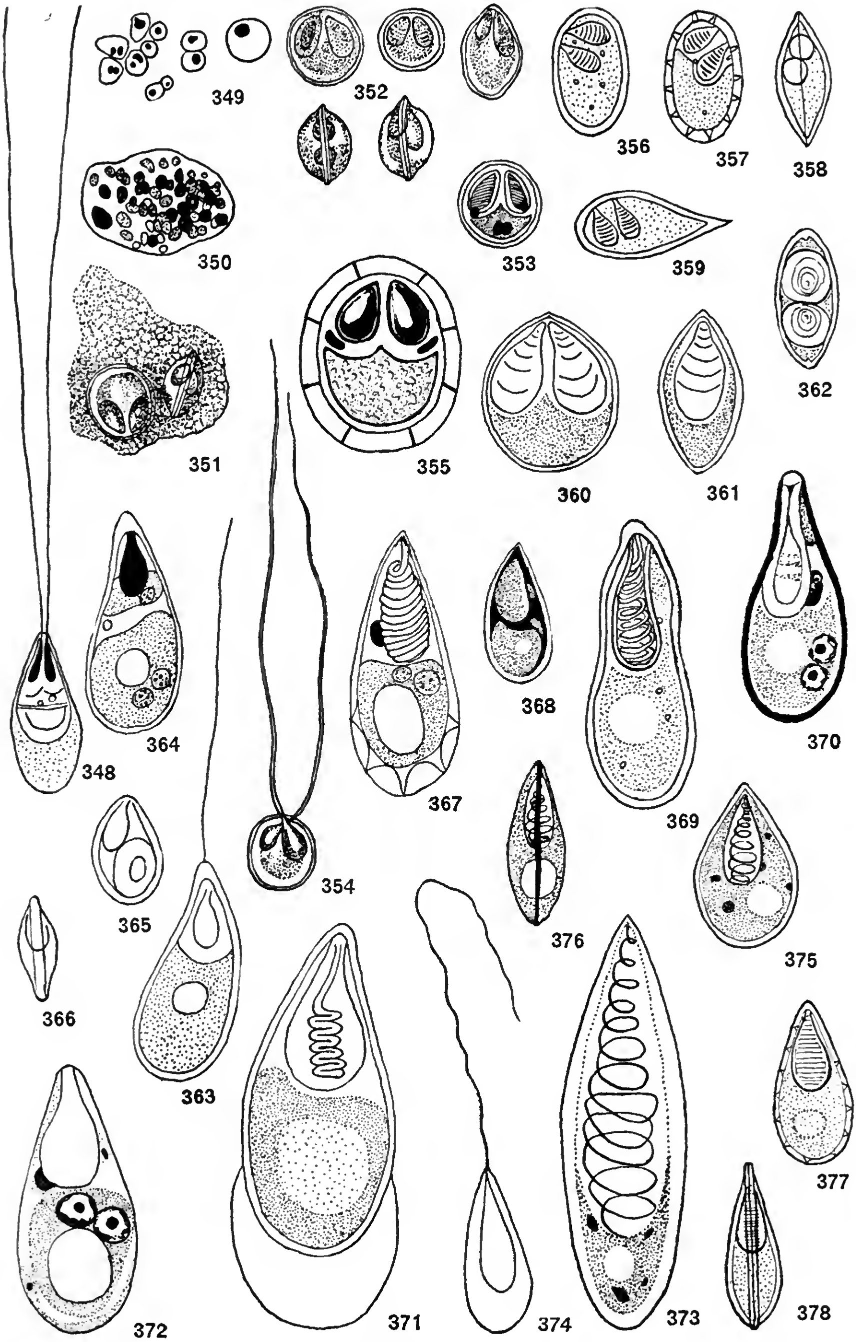

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PLATE XVI

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Figs. 379 to 385. *Myxobolus pfeifferi.*

Figs. 379 and 380. Parts of section thru cyst. After Keysselitz (1908a, Pl. 15, Figs. 1 and 2).

Fig. 381. A spore. After Thélohan (1895, Fig. 77). ×1500.

Fig. 382. An optical section of spore. After Keysselitz (1908a, Fig. A).

Fig. 383. A spore treated with Lugol's solution. After Keysselitz (1908a, Pl. 14: Fig. 92).

Fig. 384. A spore with extruded filaments. After Keysselitz (1908a, Fig. C).

Fig. 385. A stained young spore. After Keysselitz (1908a, Pl. 14, Fig. 81).

Fig. 386. A spore of *Myxobolus dispar.* After Thélohan (1895, Fig. 86). × about 1500.

Figs. 387 to 389. Spores of *Myxobolus ellipsoides.* Fig. 389. An abnormal spore with six polar capsules. After Thélohan (1895, Figs. 112, 113 and 115).

Fig. 390. A part of the infected intestine of *Mugil auratus,* showing cysts of *Myxobolus exiguus.* After Parisi (1912, Fig. 9e). × about 3.

Fig. 391. A spore of *Myxobolus exiguus.* After Thélohan (1895, Fig. 98). × 1500.

Figs. 392 to 395. Spores of *Myxobolus exiguus.* After Parisi (1912, Fig. 9). ×2500.

Fig. 396. A spore of *Myxobolus oviformis.* After Thélohan (1895, Fig. 81). ×1500.

Figs. 397 to 398. Spores of *Myxobolus mülleri.* After Thélohan (1895, Figs. 96 and 97). ×1500.

Figs. 399 and 400. Spores of *Myxobolus mülleri.* After Bütschli (1881, Figs. 1 and 2).

Fig. 401. A spore of *Myxobolus mülleri* in conc. sulphuric acid. After Bütschli (1881, Fig. 6).

Figs. 402 and 403. Abnormal spores of *Myxobolus mülleri.* After Bütschli (1881, Figs. 9 and 8).

Figs. 404 and 405. Spores of *Myxobolus lintoni.* After Linton (1891, Figs. 3 and 5).

Fig. 406. Diagram of the cross section of a spore of *Myxobolus lintoni.* After Linton (1891, Fig. 8).

Fig. 407. A spore of *Myxobolus lintoni* with extruded polar filaments. After Linton (1891, Fig. 10).

Fig. 408. A stained spore of *Myxobolus lintoni.* After Gurley (1894, Pl. 26, Fig. 7). × about 2000.

Figs. 409 and 410. Spores of *Myxobolus globosus.* After Gurley (1894, Pl. 26, Fig. 7). × about 2900.

Fig. 411. Spores of *Myxobolus inaequalis.* After Müller (1841, Fig. 6).

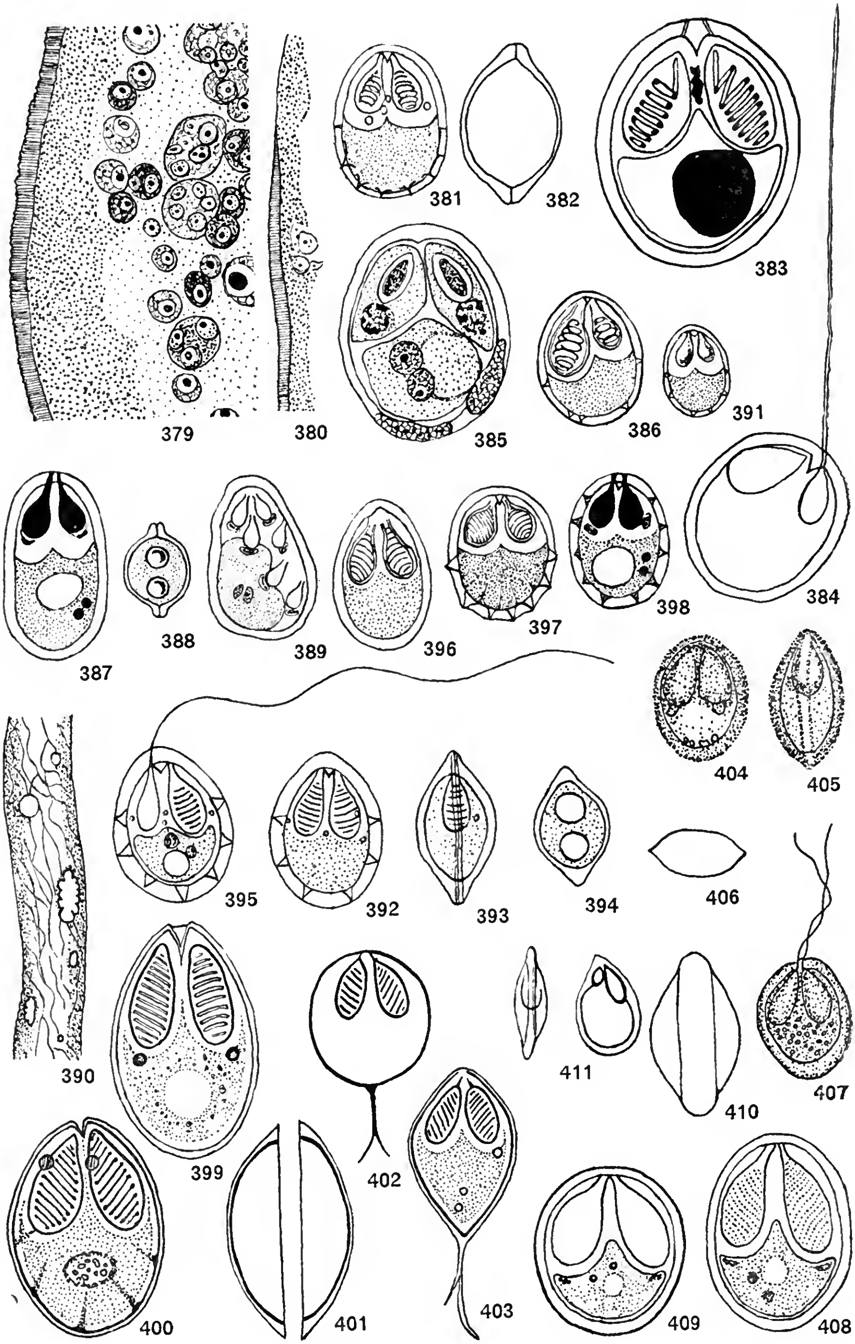

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PLATE XVII

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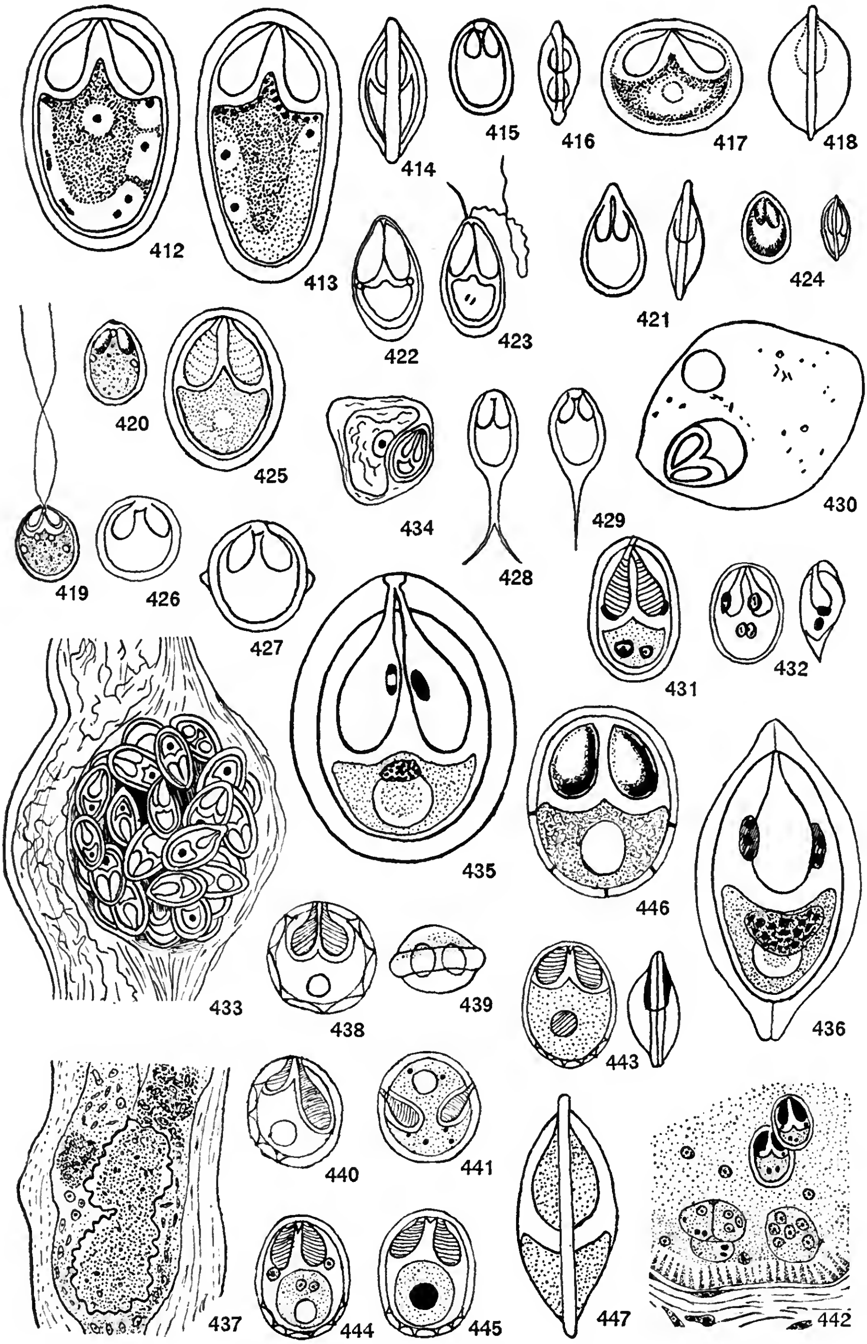
Figs. 412 to 416. Spores of *Myxobolus oblongus*. Figs. 412 to 414. After Gurley (1894, Pl. 26, Fig. 6). ×2300. Figs. 415 and 416. After Müller (1841, Fig. 9).
Figs. 417 and 418. Spores of *Myxobolus transovalis*. After Gurley (1894, Pl. 29, Fig. 1).
Figs. 419 and 420. Spores of *Myxobolus obesus*. After Balbiani (1884, Fig. 39).
Fig. 421. Spores of *Myxobolus cycloides*. After Müller (1841, Fig. 3).
Figs. 422 and 423. Spores of *Myxobolus anurus*. After Cohn (1895, Fig. 25). ×1500.
Fig. 424. Spores of *Myxobolus* sp. ×700. After Bütschli (1882, Pl. 36, Fig. 23).
Fig. 425. *Myxobolus* sp. After Gurley (1894, Pl. 28: Fig. 4a). × about 1500.
Figs. 426 to 429. Spores of *Myxobolus* sp. After Müller (1841, Fig. 4).
Fig. 430. A vegetative form of *Myxobolus cyprini*. After Doflein (1898, Fig. 112).
Figs. 431 and 432. Spores of *Myxobolus cyprini*. After Doflein (1898, Figs. 113 to 115).
Figs. 433 to 436. *Myxobolus neurobius*. After Schuberg and Schröder (1905).
Figs. 433 and 434. Longitudinal and transverse sections thru infected nerve fibres (1905, Figs. 2 and 4a). ×520.
Figs. 435 and 436. Spores (1905, Figs. 5 and 6). Comp. oc. 12 and imm. obj. 2mm.
Figs. 437 to 441. *Myxobolus aeglefini*. After Auerbach (1906a).
Fig. 437. A cyst in the sclerotic cartilage of the eye of *Gadus aeglefini* (1906a, Fig. 2).
Figs. 438 and 439. Spores (1906a, Figs. 5a and 3d). ×about 1320.
Figs. 440 and 441. Abnormal spores (1906a, Figs. 5b and 5c). ×about 1320.
Figs. 442 to 445. *Myxobolus gigas*. After Auerbach (1906b).
Fig. 442. A part of the section of a cyst (1906b, Fig. 1).
Figs. 443 to 445. Spores (1906b, Figs. 3a, 3c, 5 and 3b). × about 850.
Figs. 446 and 447. Spores of *Myxobolus volgensis*. After Reuss (1906, Fig. 1). ×2000.



KUDO STUDIES ON MYXOSPORIDIA PLATE XVII

PLATE XVIII

EXPLANATION OF PLATE

Fig. 448. The branchia of *Lucioperca volgensis* with cysts of *Myxobolus volgensis*. After Reuss (1906, Fig. 2). ×2.25.

Fig. 449. A spore of *Myxobolus scardinii*. After Reuss (1906, Fig. 3). ×1500.

Fig. 450. Air bladder of *Scardinius erythrophthalmus* with the cysts of *Myxobolus physophilus*. After Reuss (1906, Fig. 5). ×2.

Fig. 451. A spore of *Myxobolus physophilus*. After Reuss (1906, Fig. 4). ×1500.

Fig. 452. A spore of *Myxobolus macrocapsularis*. After Reuss (1906, Fig. 6). ×1500.

Fig. 453. A spore of *Myxobolus sandrae*. After Reuss (1906, Fig. 7). ×2000.

Fig. 454. A spore of *Myxobolus bramae*. After Reuss (1906, Fig. 9). ×1500.

Fig. 455. A spore of *Myxobolus balleri*. After Reuss (1906, Fig. 10). ×1500.

Fig. 456. A spore of *Myxobolus cyprinicola*. After Reuss (1906, Fig. 11). ×1500.

Figs. 457–459. *Myxobolus squamae*. After Keysselitz (1908a).

Fig. 457. A part of the infected scale (1908a, Fig. G.)

Fig. 458. A spore treated with Lugol's solution (1908a, Pl. 14, Fig. 94).

Fig. 459. A stained spore (1908a, Pl. 14, Fig. 96).

Figs. 460 and 461. Spores of *Myxobolus cordis*. After Keysselitz (1908a).

Fig. 460. A spore treated with Lugol's solution (1908a, Pl. 16, Fig. 16).

Fig. 461. A strained spore (1908a, Fig. B on page 281).

Figs. 462 to 464. Spores of *Myxobolus musculi*. After Keysselitz (1908a).

Fig. 462. A spore treated with Lugol's solution (1908a, Pl. 15, Fig. 13).

Fig. 463 and 464. Stained spores (1908a, Figs. D and E on page 286).

Fig. 465. Spores of *Myxobolus* sp. After Wegener (1910, Fig. 44). ×1050.

Fig. 466. A spore of *Myxobolus permagnus*. After Wegener (1910, Fig. 45). ×1050.

Fig. 467. Spores of *Myxobolus rotundus*. After Nemeczek (1911, Figs. 10 and 11). ×1000.

Fig. 468. Spores of *Myxobolus minutus*. After Nemeczek (1911, Figs. 16 and 17). ×1000.

Figs. 469 and 470. Spores of *Myxobolus magnus*. After Awerinzew (1913, 76). × about 340.

Figs. 471 to 473. Spores of *Myxobolus carassii*. After Klokacewa (1914, Fig. 1). × about 2400.

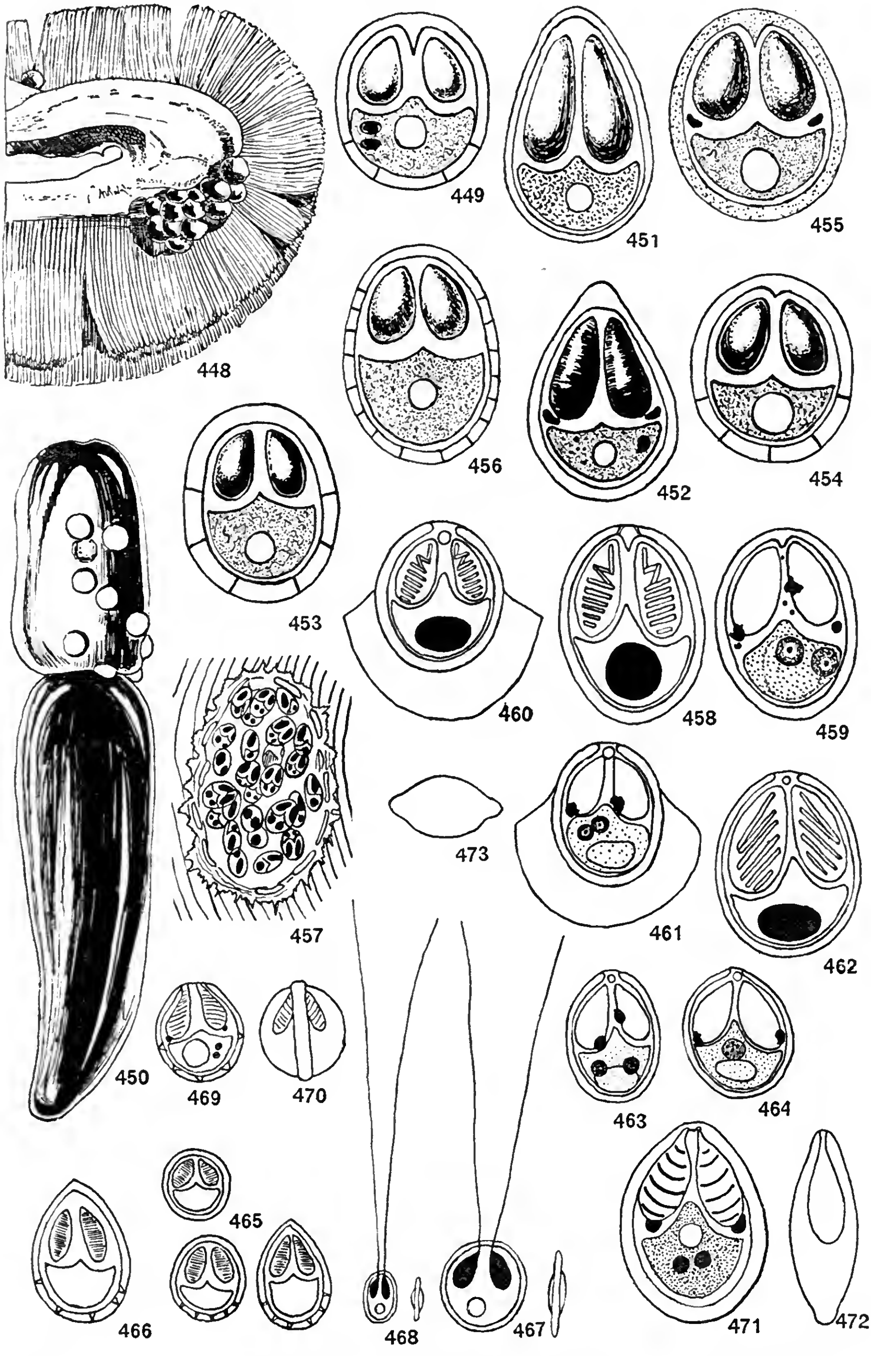


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PLATE XIX

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Figs. 474 to 476. *Myxobolus funduli.* After Hahn (1915 and 1917).
Fig. 474. A cyst from the gill filament (1917, Fig. 1).
Fig. 475. A stained spore (1915, Fig. 28). ×2000.
Fig. 476. Diagram of the cross section of a spore (1915, Fig. 30).
Fig. 477. A spore of *Myxobolus pleuronectidae.* After Hahn (1917a, Fig. 2). ×1575.
Fig. 478. A spore of *Myxobolus capsulatus.* After Davis (1917, Fig. 139). ×1500.
Figs. 479 and 480. Spores of *Myxobolus nodularis.* After Southwell and Prashad (1918, Pl. 11, Figs. 34 and 35). × about 1450.
Fig. 481. A spore of *Myxobolus miyairii.* After Miyairi (1909, Fig. 14).
Figs. 482 to 485. Spores of *Myxobolus koi.* Original. ×1300.
Figs. 482 to 484. Different views.
Fig. 485. A spore stained with Giemsa's mixture.
Figs. 486 and 487. *Henneguya psorospermica.* After Thélohan (1895).
Fig. 486. A cross section thru branchial lamella of *Esox lucius* with a cyst (1895, Fig. 82).
Fig. 487. Two spores (1895, Figs. 83 and 84). × about 1000.
Figs. 488 and 489. *Henneguya minuta.* After Cohn (1895).
Fig. 488. A longitudinal section of an infected branchial lamella (1895, Fig. 29.)
Fig. 489. Two spores. One with two vacuoles(?) (1895, Fig. 30). × about 450.
Fig. 490 and 491. Spores of *Henneguya oviperda.* After Cohn (1895, Fig. 31).
Fig. 491. A spore with extruded "starren Fäden" and polar filaments.
Figs. 492 and 493. *Henneguya lobosa.* After Cohn.
Fig. 492. An external view of the parasite on the gill (1895, Fig. 18).
Fig. 493. Two spores and one unseparated young spores (1895, Fig. 21).
Figs. 494 and 495. *Henneguya media.* After Thélohan (1890b).
Fig. 494. A sporoblast in the ovary of Gasterosteus, with one spore (1890b, Fig. 18).
Fig. 495. Spores (1890b, Fig. 1).
Fig. 496. The peripheral portion of a section of a cyst of *Henneguya psorospermica,* showing the characteristic structure. After Thélohan (1895: 237).
Figs. 497 to 499. Spores of *Henneguya schizura.* After Müller (1841, Fig. 1).
Figs. 500 to 503. Spores of *Henneguya creplini.* After Creplin (1842, Figs. B, E, A and C).
Fig. 504. Spores of *Henneguya linearis.* After Müller (1841, Fig. 10).

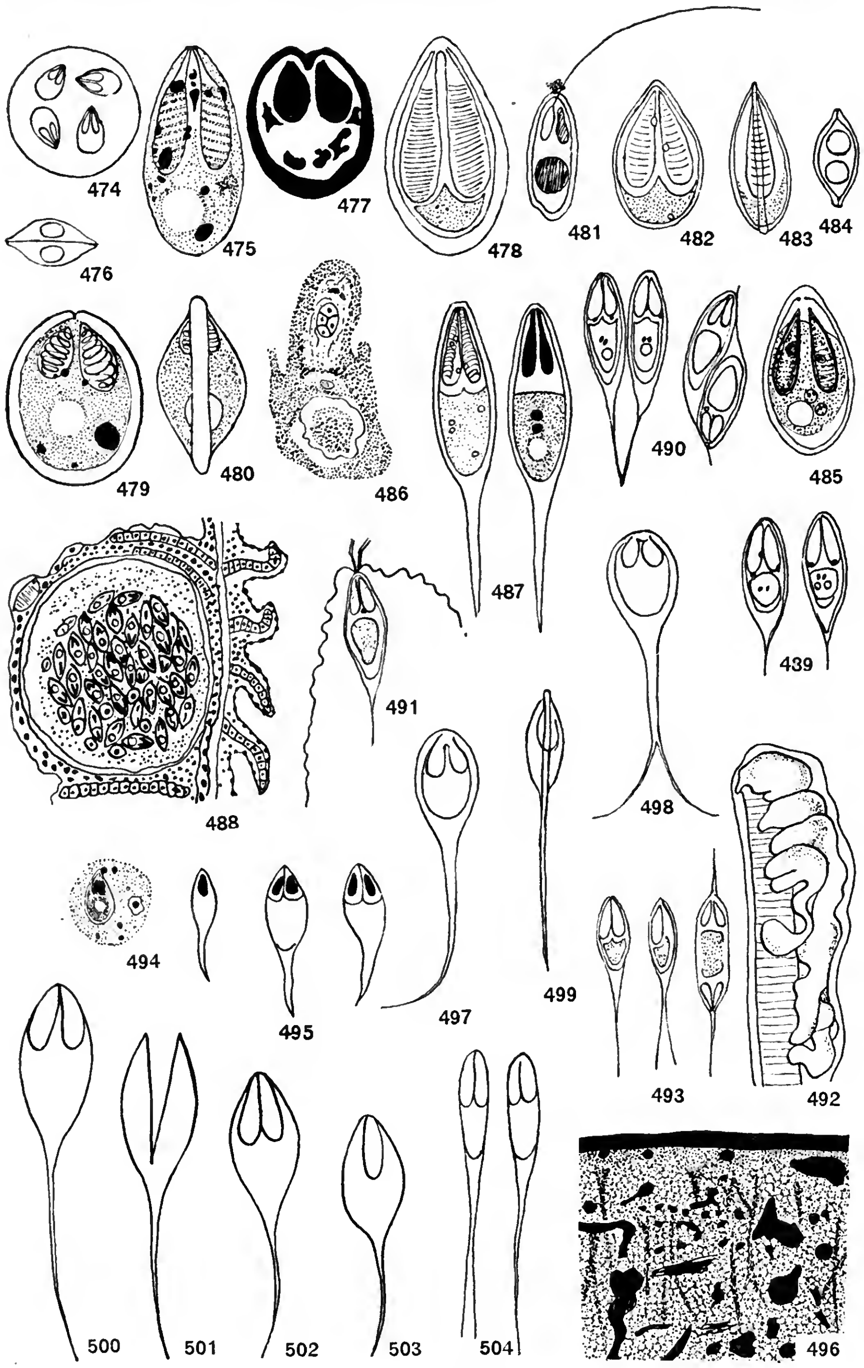
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PLATE XX

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Fig. 505. Spores of *Henneguya Gurleyi*. After Gurley (1894, Pl. 33, Figs. 8c, 6 and 7). × about 3100.
Fig. 506. Spores of *Henneguya strongylura*. After Müller (1841, Fig. 2).
Fig. 507. Spores of *Henneguya monura*. After Ryder (1880, Figs. 1c and 2d).
Fig. 508. Spores of *Henneguya kolesnikovi*. After Kolesnikov from Gurley (1894, Pl. 35, Fig. 7).
Figs. 509 to 512. *Henneguya macrura*. After Gurley (1894). × about 2100.
Figs. 509 and 510. Spores (1894, Pl. 32, Fig. 5, Pl. 33, Fig. 1).
Fig. 511. A spore treated with iodine, showing the "beading of the tail" (1894, Pl. 33, Fig. 3).
Fig. 512. A tail separated from the main part by iodine (1894, Pl. 33, Fig. 4).
Fig. 513. Spores of *Henneguya zschokkei*. After Zschokke (1898, Figs. 2 and 1).
Fig. 514. Spores of *Henneguya* sp. After Benecke from Gurley (1894, Pl. 29, Fig. 8).
Fig. 515. Spore of *Henneguya tenuis*. After Vaney and Conte (1901, Fig. 2).
Figs. 516 and 517. Spores of *Henneguya nüsslini*. After Schuberg and Schröder (1905, Figs. 13 and 14). Comp. oc. 12 and obj. 2mm.
Figs. 518 to 523. *Henneguya legeri*. After Cépède (1913).
Figs. 518 to 521. Trophozoites (1913, Figs. 2, 23, 15 and 25). ×900.
Fig. 519. A trophozoite in division (1913, Fig. 23). ×900.
Fig. 521. A trophozoite stained with iron hematoxylin (1913, Fig. 25). ×900.
Fig. 522. An elongated spore (1913, Fig. 26). ×900.
Fig. 523. An ovoidal spore (1913, Fig. 24). ×450.
Fig. 524. A spore of *Henneguya miyairii*. After Miyairi (1909, Fig. 11).

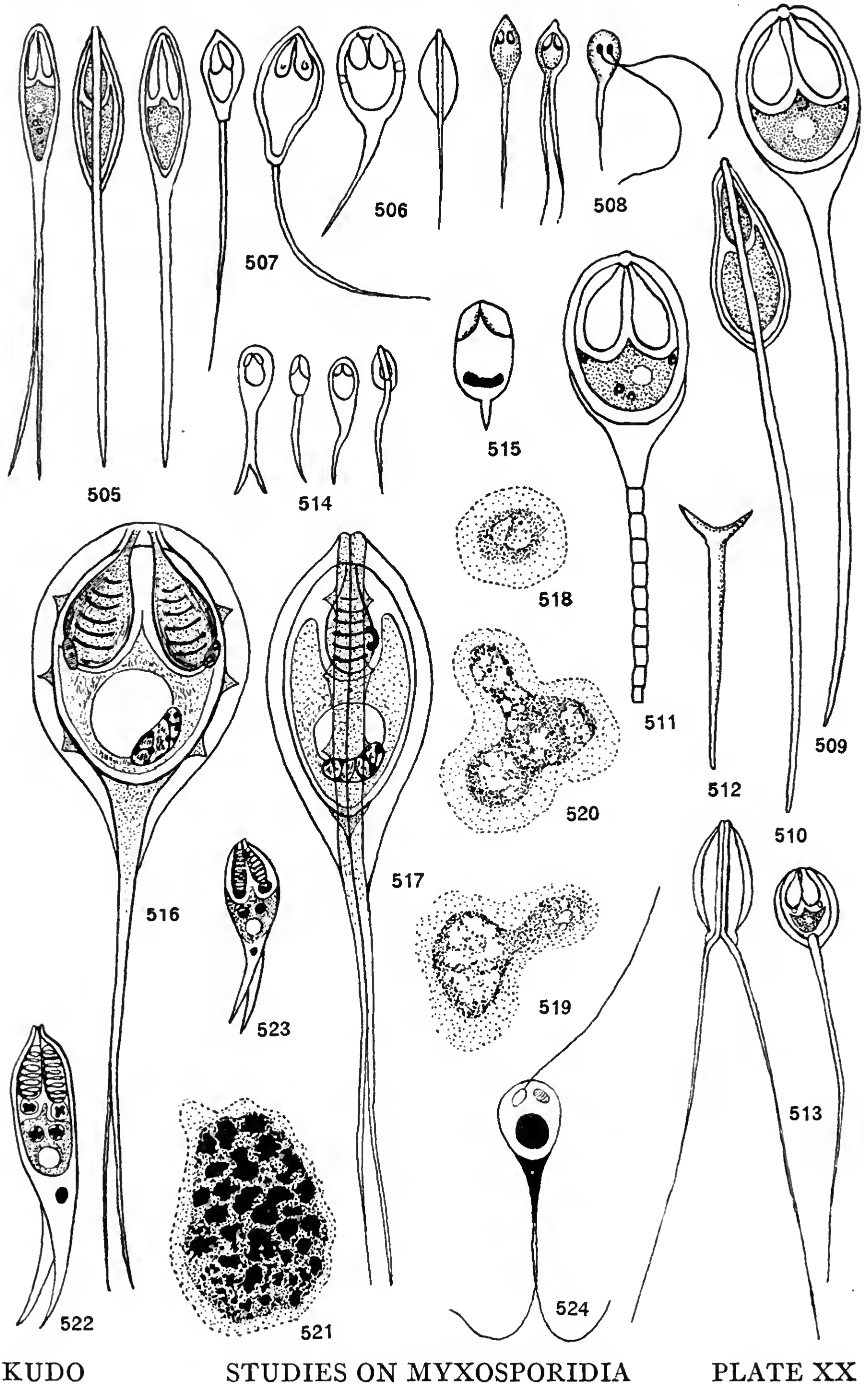
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PLATE XXI

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Figs. 525 and 526. Spores of ***Henneguya acerinae***. After Schröder (1906, Figs. 5 and 6). ×1650.

Figs. 527 to 535. ***Henneguya gigantea***. After Nemeczek (1911). ×1000.

Fig. 527. A mature spore with extruded polar filaments (1911, Fig. 1).

Figs. 528 to 535. Stages in development of spores (1911, Figs. 2 to 9).

Figs. 536 to 539. Spores of *Henneguya*(?) sp. After Nemeczek (1911, Figs. 12 to 15). ×1000.

Figs. 540 to 543. ***Henneguya gasterostei***. After Parisi (1912). × about 1500.

Fig. 540. A disporous trophozoite (1912, Fig. 10d).

Figs. 541 and 542. Two spores (1912, Figs. 10f and 10e).

Fig. 543. A young spore (1912, Fig. 10c).

Figs. 544 and 545. Spores of ***Henneguya neapolitana***. After Parisi (1912, Fig. 11). × about 1500.

Figs. 546 to 549. Various trophozoites of ***Henneguya mictospora***. Original.

Fig. 546. A monosporous trophozoite with a young spore. ×950.

Figs. 547 and 549. Trophozoites in vivo. ×650.

Fig. 548. A stained binucleated young trophozoite. ×1700.

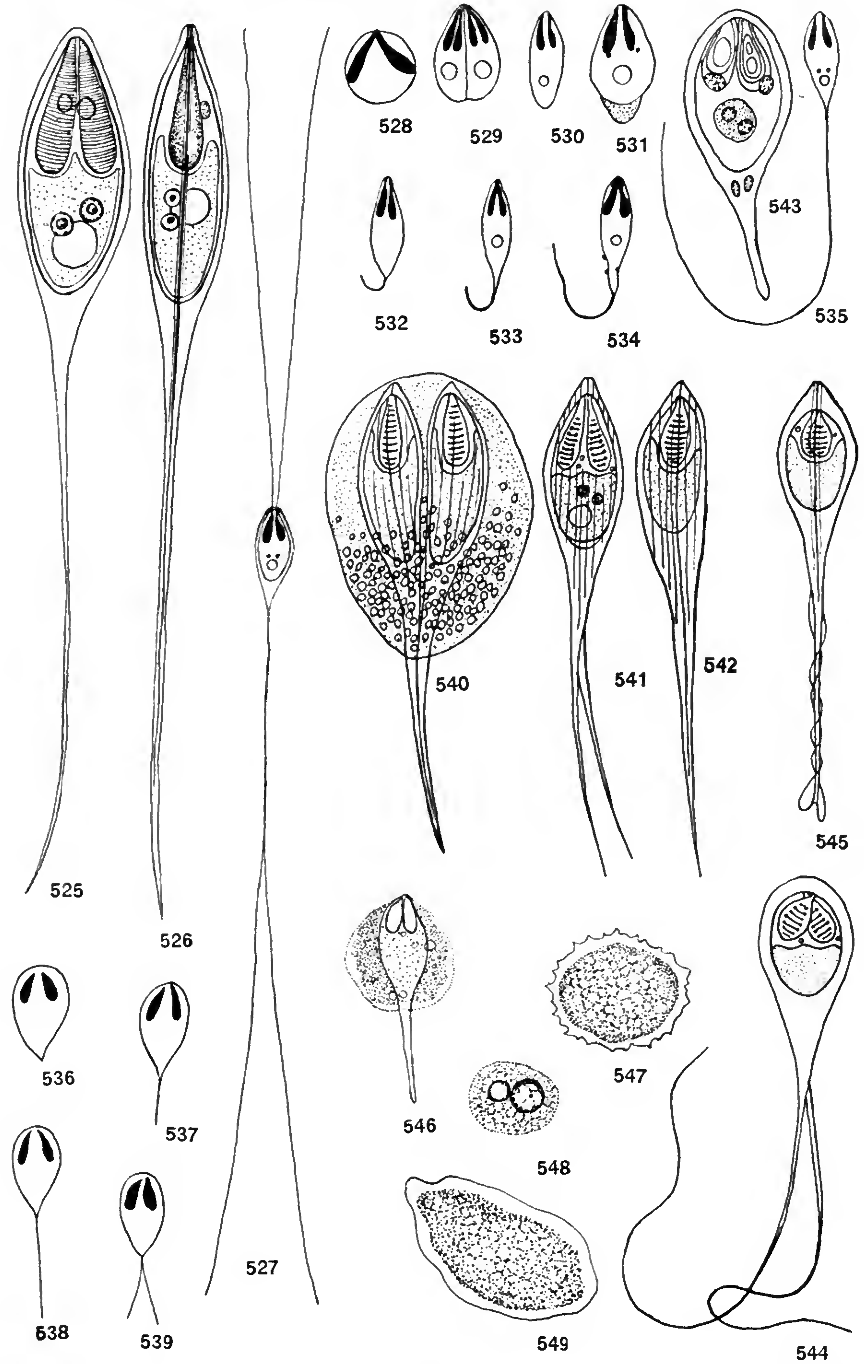
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PLATE XXII

EXPLANATION OF PLATE

Figs. 550 to 557. *Henneguya mictospora.* Original.
Fig. 550. A stained trophozoite. ×1700.
Figs. 551 to 553. Three different stages of development of disporous trophozoites. Giemsa. ×1700.
Figs. 554 and 555. Two stages of monosporous trophozoites. Giemsa. ×1700.
Figs. 556 and 557. Different views of mature spores in vivo. ×2000.
Figs. 558 and 559. *Henneguya wisconsinensis.* After Mavor and Strasser (1916).
Fig. 558. A trophozoite in vivo (1916, Fig. 1a). ×570.
Fig. 559. A fresh spore (1916, Fig. 3d). ×4000.
Figs 560 and 561. Trophozoites of *Chloromyxum catostomi.* Original. ×1500.
Figs. 562 to 565. *Chloromyxum clupeidae.* Original drawn from Dr. Tyzzer's smears which were restained. ×2360.
Fig. 562. Anterior end view of two spores in preserved and decolorized smears.
Fig. 563. The same views of three spores restained with Giemsa mixture.
Fig. 564. Front view of a preserved and decolorized spore.
Fig. 565. The same views of two spores restained with Giemsa's mixture.
Figs. 566 to 572. Spores of *Myxobolus orbiculatus.* Original.
Figs. 566, 569 and 570. Different views of normal spores in preserved specimen. ×1500.
Figs. 567 and 568. Abnormal spores. ×1500.
Fig. 571. A spore stained with Lugol's solution. ×1500.
Fig. 572. A spore stained with Giemsa's mixture. ×2360.

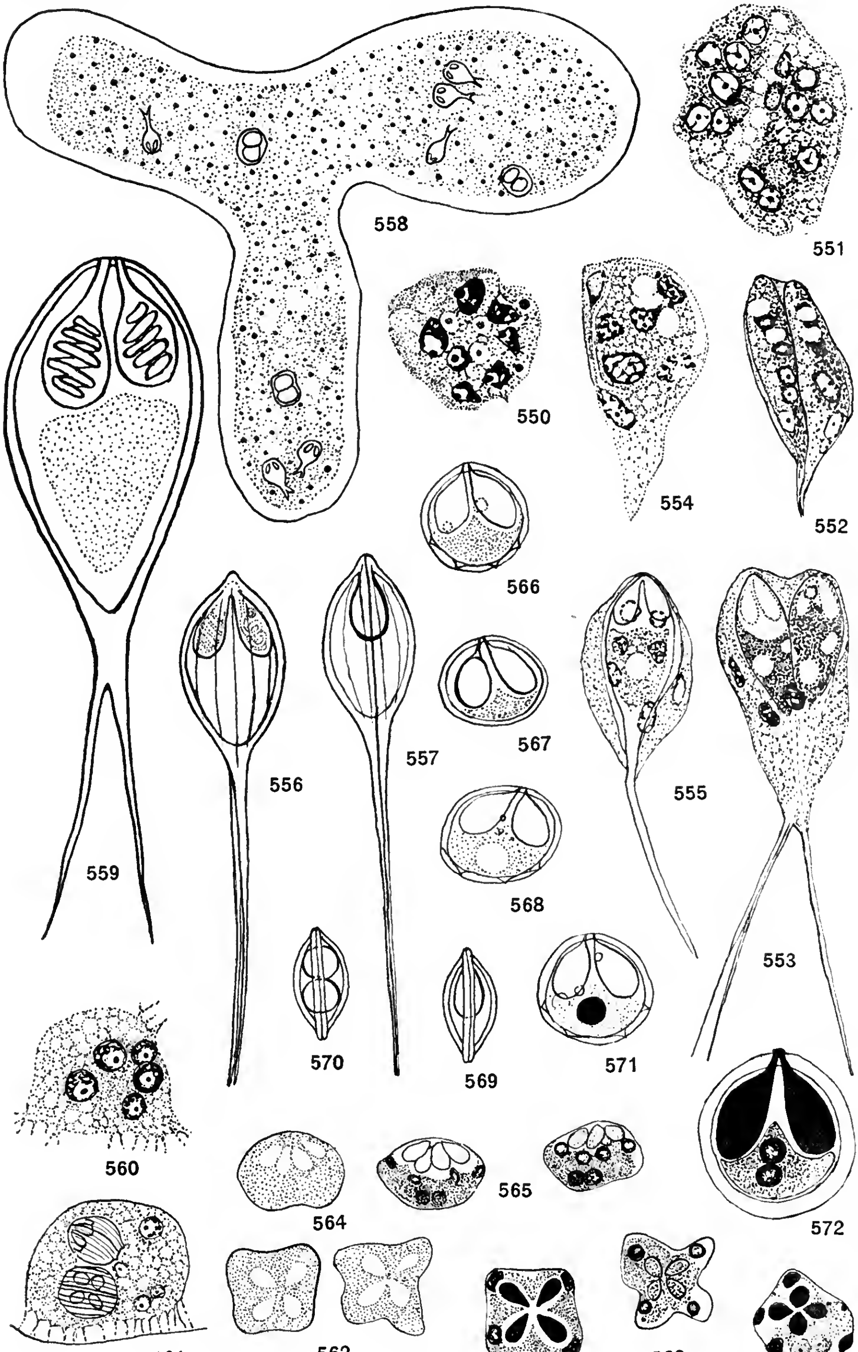
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PLATE XXIII

EXPLANATION OF PLATE

Figs. 573 to 576. *Myxobolus orbiculatus*. Original.

Fig. 573. Young vegetative forms in the muscle fibres. From a section stained with Heidenhain's iron hematoxylin. ×900.

Figs. 574 and 575. Two vegetative forms under higher magnifications. ×1500.

Fig. 576. A cross section thru the infected muscle fibres, stained with Heidenhain's iron hematoxylin. ×900.

Figs. 577 to 581. *Hoferellus cyprini*. After Doflein (1898).

Figs. 577 and 578. Two vegetative forms (1898, Figs. 106 and 105).

Figs. 579 to 581. Spores (1898, Figs. 108 and 107).

Figs. 582 and 583. Genus incert. *merlucii*. After Perugia from Gurley (1894, Pl. 29, Figs. 2 and 7).

Figs. 584 and 585. Genus incert. *congri*. After Perugia from Gurley (1894, Pl. 6, Figs. 7 and 3).

Figs. 586 and 587. Genus et species incertae. After Mavor (1915).

Fig. 586. A trophozoite with attached *Ceratomyxa acadiensis* (1915, Fig. 8). ×830.

Fig. 587. A trophozoite (1915, Fig. 6).

Figs. 588 and 589. Trophozoites of genus et species incertae. After Mavor (1916a, Figs. 3d and 3b). ×660.

Fig. 586. A trophozoite with attached *Ceratomyxa acadiensis* (1915, Fig. 8). ×830.

Fig. 587. A trophozoite (1915, Fig. 6).

Figs. 588 and 589. Trophozoites of genus et species incertae. After Mavor (1916a, Figs. 3d and 3b). ×660.

Fig. 590. Spores of genus et species incertae. After Linton (1891a, Fig. 2).

Figs. 591 to 593. *Myxobolus hylae*. After Johnston and Bancroft (1918).

Fig. 591. A transverse section of a heavily infected testis of *Hyla aurea*, (1918, Fig. 1). × about 11.

Fig. 592. Different views of normal spores, stained (1918, Fig. 3). × about 800.

Fig. 593. Abnormal spores (1918, Fig. 4). × about 800.

Figs. 594 to 596. *Lentospora dermatobia*. After Ishii (1915).

Fig. 594. A part of the infected skin of the host (1915, Fig. 2). ×140.

Figs. 595 and 596. Different views of spore (1915, Figs. 4 and 3). ×1450.

Figs. 597 to 601. *Myxobolus discrepans*. Original.

Fig. 597. An infected branchial lamella showing the cysts of various size and form. × about 4.

Figs. 598 to 601. Unstained preserved spores, showing different views. × about 1500.

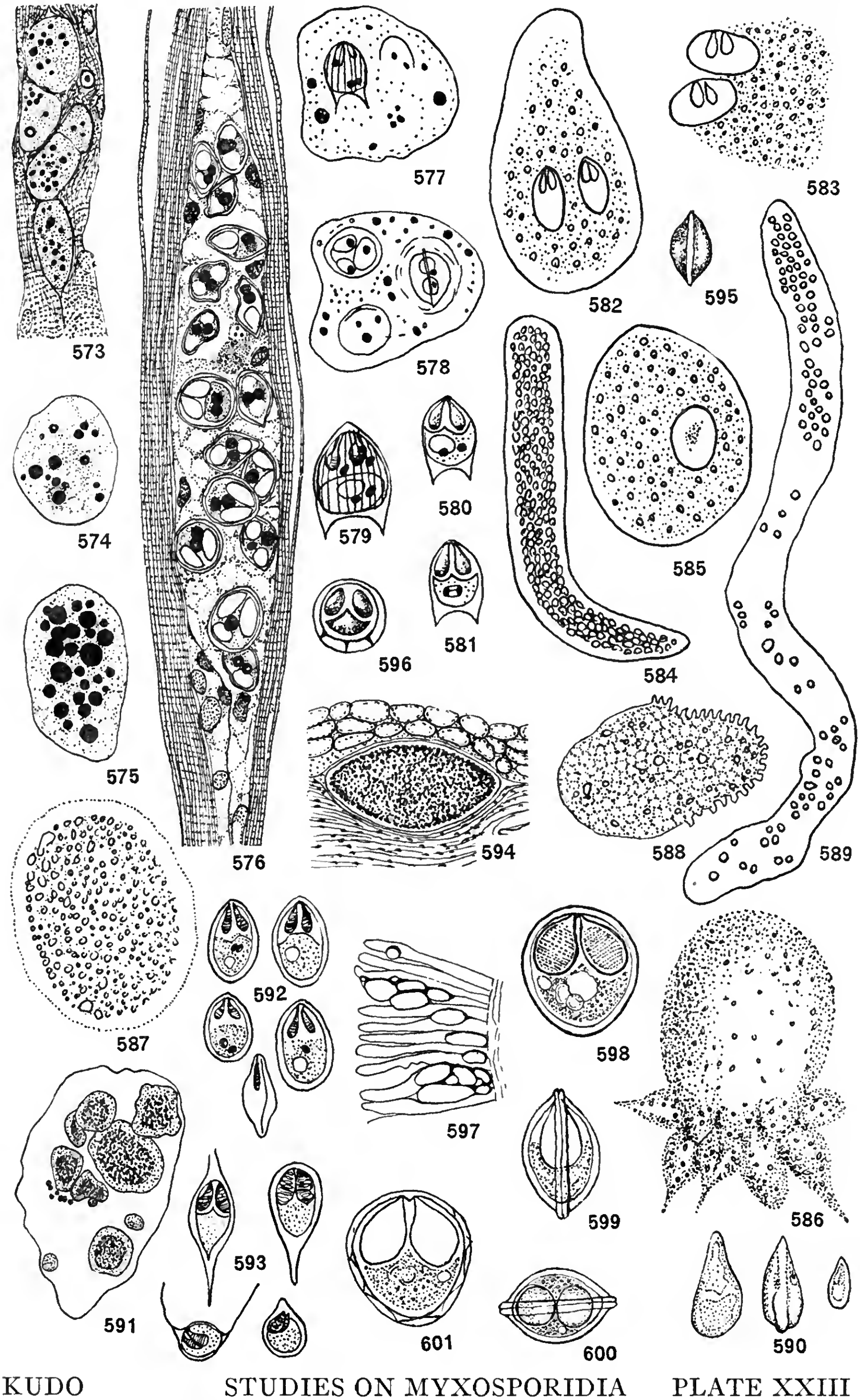
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PLATE XXIV

EXPLANATION OF PLATE

Figs. 602 to 621. *Mitraspora elongata.* Original. ×1500, except Figs. 620 and 621, ×2500. Giemsa staining, unless otherwise stated.
Fig. 602. A trophozoite showing various nuclei and sporoblasts at different stages of development.
Fig. 603. A trophozoite with a mature and a young spore. Iron hematoxylin.
Fig. 604. A trophozoite with two mature spores.
Figs. 605 to 609. Formation and development of sporoblasts.
Figs. 610 to 613. Developing spores. Fig. 612; Delafield's hematoxylin.
Fig. 614. A surface view of a preserved spore.
Fig. 615. An optical section of a preserved spore.
Fig. 616. Front view of a stained spore.
Fig. 617. Lateral view of a spore stained with Heidenhain's iron hematoxylin.
Fig. 618. A slightly elongated spore.
Fig. 619. An abnormal spore.
Fig. 620. A longitudinal section thru a polar capsule.
Fig. 621. An oblique view of a polar capsule, showing the spirally coiled polar filament.
Figs. 622 to 627. *Myxidium americanum.* Original. ×1500.
Figs. 622 and 623. Two young trophozoites. Giemsa.
Fig. 624. A sporulating trophozoite in unstained preserved state.
Fig. 625. A spore in preserved state.
Fig. 626. A fresh spore treated with potassium hydrate solution.
Fig. 627. A spore stained with Giemsa's mixture.
Figs. 628 to 631. *Myxobolus mesentericus.* Original. ×1500.
Figs. 628 and 629. Front and lateral views of unstained preserved spores.
Fig. 630. A Giemsa stained spore.
Fig. 631. A spore with extruded polar filament (potassium hydrate), stained with Giemsa's mixture.

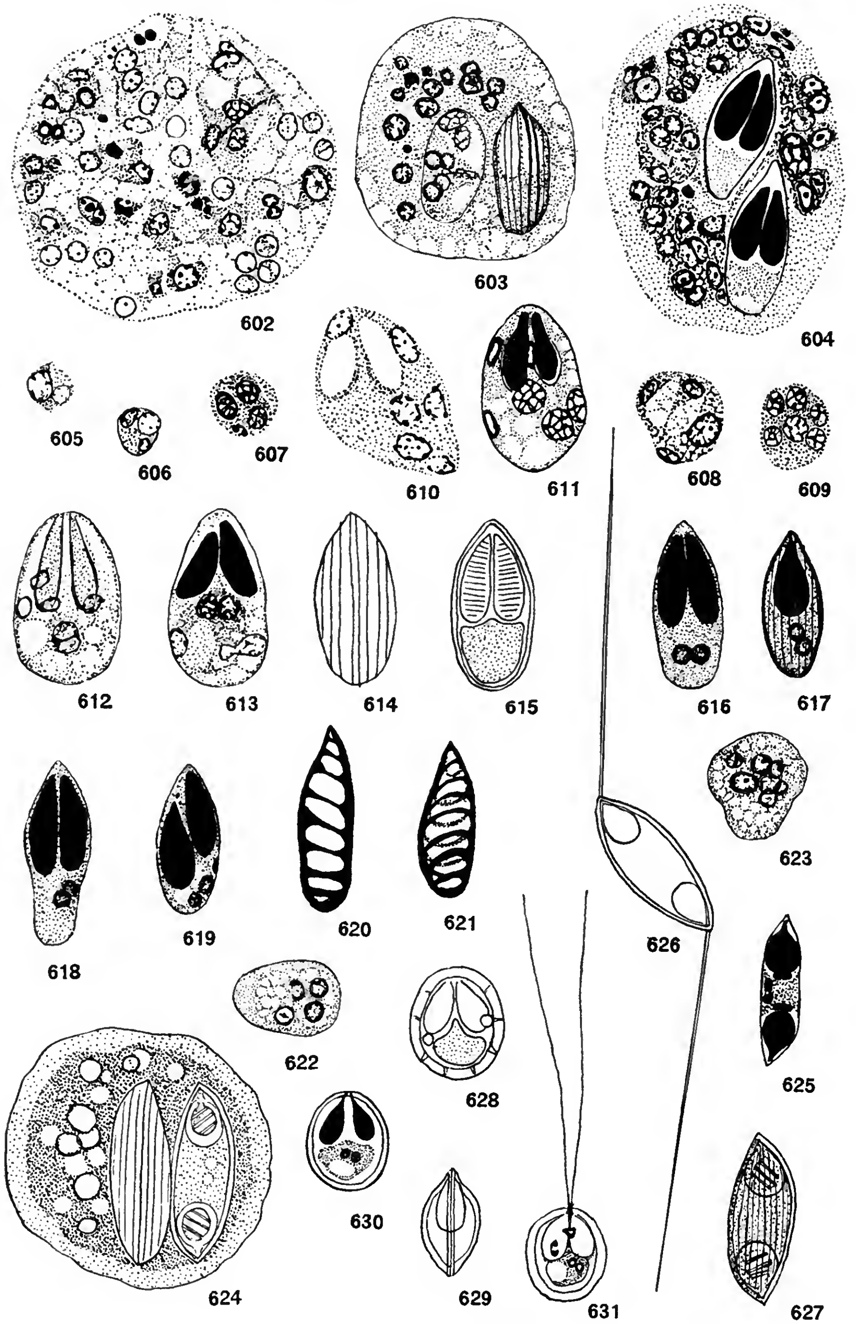
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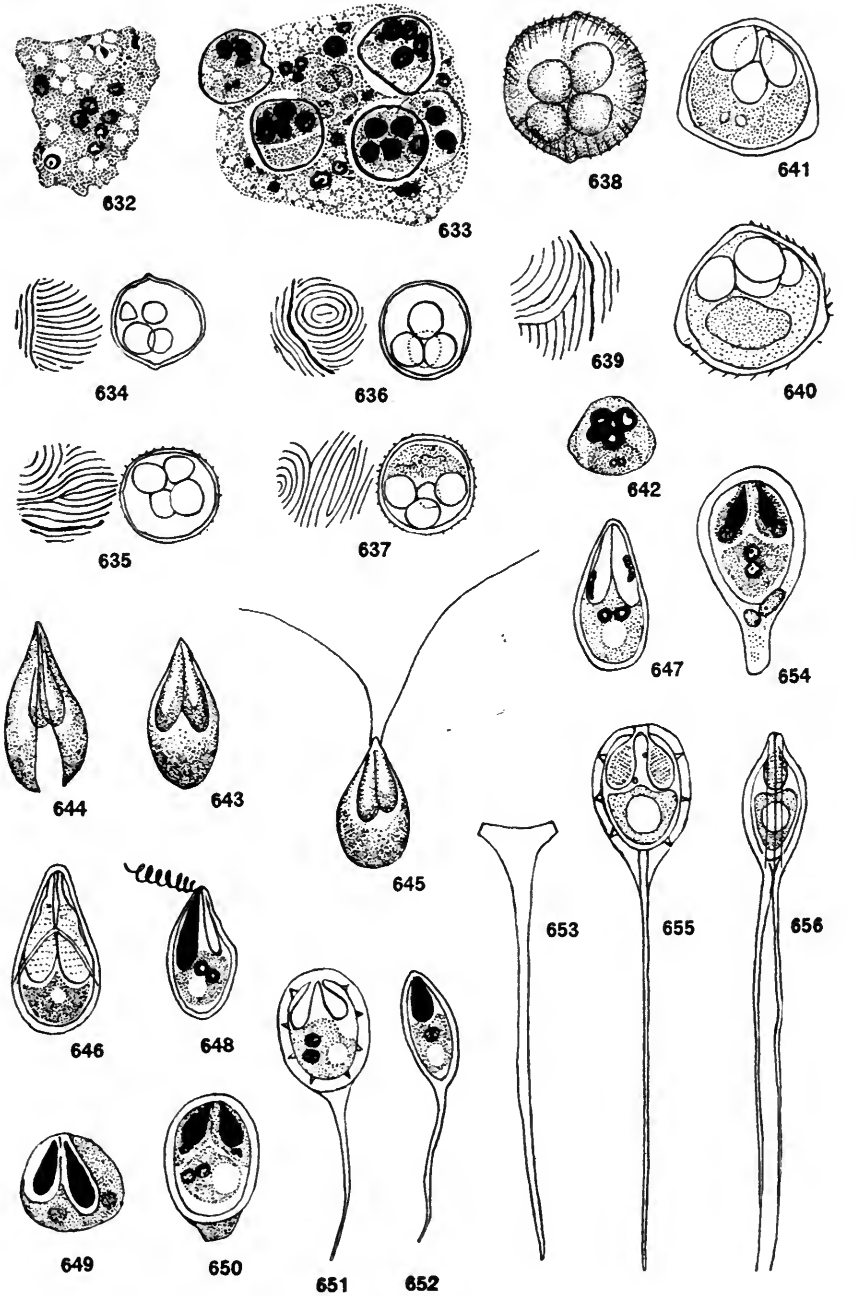
PLATE XXV

EXPLANATION OF PLATE

Figs. 632 to 642. *Chloromyxum wardi.* Original.
Fig. 632. A young trophozoite. Smear and Giemsa. ×1500.
Fig. 633. A sporulating trophozoite. Giemsa. ×1500.
Figs. 634 to 637. Surface views and optical sections of four unstained spores, showing the sutural ridge and the fine striations on the shell. ×1500.
Fig. 638. A polar view of unstained spore. ×2360.
Figs. 640. Surface view and optical section of a single spore. ×2360.
Fig. 641. A front view of an unstained spore. ×2360.
Fig. 642. A Giemsa stained spore. ×1500.
Figs. 643 to 649. *Myxobolus aureatus.* After Ward (1919).
Fig. 643. A fresh spore (1919, Fig. Aa).
Figs. 644 and 645. Fresh spores kept for 24 hours or more in water (1919, Fig. Aa).
Fig. 646. A preserved unstained spore (1919, Fig. Ba).
Fig. 647. A spore stained with Delafield's hematoxylin (1919, Fig. Bd). ×1500.
Fig. 648. A spore with an extruded polar filament from section preparation stained with Giemsa's mixture (1919, Fig. Bg). ×1500.
Fig. 649. A young spore, stained with Giemsa's mixture (1919, Fig. Bi). ×1500.
Figs. 650 to 653. *Henneguya brachyura.* After Ward (1919). ×1500.
Fig. 650. A young spore stained with Giemsa's mixture (1919, Fig. Ce).
Figs. 651 and 652. Front and lateral views of spore (1919: Figs. Cb and Cc).
Fig. 653. A detached tail (1919, Fig. Cf).
Figs. 654 to 656. *Henneguya salminicola.* After Ward (1919). ×1500.
Fig. 654. A young spore stained with Giemsa's mixture (1919, Fig. Fc).
Figs. 655 and 656. Front and lateral views of unstained preserved spores.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