Bulletin of the Faculty of Education, Yamaguchi University, Vol. 28, Pt. 2

Notes on the Gregarines in Japan 9.

Three New Eugregarines and Nine Other Gregarines from Orthoptera and Dictyoptera.

by

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This is one of the series of papers to put the gregarines found in Japan in order. In this paper the author wants to describe three new and ten already known species of gregarines from Japanese Orthoptera and Dictyoptera. As for the known species he rewrites the description with the system which he proposed in the previous paper. By this time 11 eugregarines have been reported from 14 Orthoptera and 1 from 2 Dictyoptera. Among the known species three gregarines, *Gregarina korogi*, *Leidyana erratica* and *Leidyana suzumushi*, have already been described with the proposed system so the description of these three gregarines is omitted from this paper.

On the parasitism of the gregarines described in this paper some interesting facts are observed. Some of them show little severe host specificity and they parasitized different species of host. For example, *Coronoepimeritus japonicus* is parasitic on four different hosts and *Gregarina blattarum*, *Gregarina inago*, and *Leidyana oviformis* are parasitic on two different hosts. On the other hand some of the host Orthoptera are infected with two different species of gregarines in their digestive tract. *Gryllus yemma* and *Pteronemobius taprobanensis* are infected with *Leidyana* and *Gregarina*. *Oxya velox* and *Oxya japonicus* are infected with *Gregarina* and *Coronoepimeritus*. *Diestrammena japonica* is infected with two species of *Gregarina*.

The List of Gregarines from Japanese Orthoptera and Dictyoptera

Parasites	Hosts
Gregarinidae	
Leidyana erratica (Crawley) Watson	*Gryllus yemma* Ohmachi et Matsuura
Leidyana suzumushi K. Hoshide	*Homoeogryllus japonicus* de Haan
Leidyana oviformis n. sp.	*Pteronemobius fascipes* Walker
	Pteronemobius taprobanensis Walker
Gregarina blattarum Siebold	*Periplaneta americana* L.
	Blattela germanica L.
Gregarina inago H. Hoshide	*Oxya velox* Fabricius

	Oxya japonicus Willesme
Gregarina acantholobae H. Hoshide	*Acantholobus japonicus* de Haan
Gregarina concava H. Hoshide	*Gampsocleis burgeri* de Haan
Gregarina korogi H. Hoshide	*Gryllus yemma* Ohmachi et Matsuura
Gregarina scapsipedae H. Hoshide	*Scapsipedes asperus* Walker
Gregarina arietulidae n. sp.	*Loxoblemmus arietulus* Saussure
Gregarina parva n. sp.	*Pteronemobius taprobanensis* Walker
Gregarina diestrammenae H. Hoshide	*Diestrammena japonica* Kerny
Gregarina monoducta H. Hoshide	*Diestrammena japonica* Kerny

Acanthosporidae

Coronoepimeritus japonicus H. Hoshide	*Locusta migratoria danica* L.
	Oxya japonicus Willesme
	Oxya velox Fabricius
	Oedaleus infernalis de Saussure
Coronoepimeritus monospinus H. Hoshide	*Euconocephalus thumbergi* Stal

Leidyana erratica (Crawley) Watson 1916

1903	*Gregarina achetaeabbreviatus*	Crawley	1903 : 45
1907	*Stenophora erratica*	Crawely	1907 : 221
1915	*Leidyana solitaria*	Watson	1915 : 35
1916	*Leidyana erratica*	Watson	1916 : 328
1973	*Leidyana erratica*	K. Hoshide	1973 : 79

Host : *Gryllus yemma* Ohmachi et Matsuura Orthoptera, Gryllidae
Habitat : Intestine
Locality : Yamaguchi, Obatake, Iwakuni (Yamaguchi Pref.)

Leidyana suzumushi K. Hoshide 1973

1973	*Leidyana suzumushi*	K. Hoshide	1973 : 69

Host : *Homoeogryllus japonicus* de Haan Orthoptera, Gryllidae
Habitat : Gastric caeca, intestine
Locality : Tabuse (Yamaguchi Pref.)

Gregarina korogi H. Hoshide 1952

1952	*Gregarina korogi*	H. Hoshide	1952 : 118
1973	*Gregarina korogi*	K. Hoshide	1973 : 77

Host : *Gryllus yemma* Ohmachi et Matsuura Orthoptera, Gryllidae
Habitat : Intestine, Gastric caeca
Locality : Hikari, Obatake, Yamaguchi (Yamaguchi Pref.)

Leidyana oviformis n. sp.

Host : *Pteronemobius fascipes* Walker, *P. taprobanensis* Walker
Orthoptera, Gryllidae

Habitat : Gastric caeca, mid intestine

Locality : Iwakuni, Yamaguchi (Yamaguchi Pref.)

I. Sporadin

1. Association	Solitary.
2. Measurements	
2—1. Size	
Maximum	TL 350 LP 65 LD 285 WP 88 WD 169
Average	TL 281 LP 50 LD 231 WP 63 WD 110
2—2. Ratio	LP : TL= 1 : 5.6 WP : WD= 1 : 1.7
3. Shape	Ovoidal, matured sporadins lose their epimerite.
4. Protomerite	
4—1. Shape	Dome-shaped, slightly wider than high, with small mammilate projection at apex. In living specimens anterior half of protomerite constricted and formed like cylinder.
5. Deutomerite	
5—1. Shape	Ovoidal, its width about half of total length of body, tapering to a blunt point at posterior end. In early stage of sporadin, deutomerite slender, change form from cylindrical to ellipsoidal.
6. Septum	Distinct, constriction fairly deep.
7. Nucleus	
7—1. Shape	Spherical, 25—30μ in diameter. Not visible in living well matured specimens.
7—2. Position	Generally in middle region of deutomerite but unfixed, sometimes anteriorly or other times posteriorly.
7—3. Nucleolus	One.
8. Endoplasm	
8—1. Color	Brown, color of body uniformaly same throughout except anterior half of protomerite which is much faint.
8—2. Granules	Dense, containing fine granules.
9. Ectoplasm	Rather thick, about 2.5μ in thickness.

II. Cyst

1. Structure	Spherical, average 155μ in diameter, covered with two membranes ; inner thin 2—3μ transparent, outer thick 20—25μ gelatinous stratified with many fine layers.

2. Dehiscence — By 1 — 5 sporeducts, each 60μ in length.

III. Spore

1. Shape — Barrel-shaped.

2. Size — 6 x 3 μ

IV. Movement — Fairly active, sliding and bending observed.

V. Cephalin

1. Shape — One of rather young cephalins measured as follows : TL 35 LP 10 LD 25 WP 8 WD 25 LE 18 (unit μ) Ovoidal.

2. Structure — Almost transparent in young stage with small quantity of endoplasm.

3. Epimerite — Elongate spatula-shaped 3 x 18μ in some specimens

Table 1. *Leidyana oviformis* n. sp.
Measurements and Ratio of Sporadins (unit μ)

TL	350	321	294	285	260	243
LP	65	63	53	50	45	44
LD	285	258	241	235	215	199
WP	88	78	63	60	60	49
WD	169	134	91	100	110	69
Ratio						
LP : TL	1 : 5.4	1 : 5.1	1 : 5.5	1 : 5.7	1 : 5.8	1 : 5.5
WP : WD	1 : 1.9	1 : 1.7	1 : 1.4	1 : 1.7	I : 1.8	1 : 1.4

Remarks :

This parasite belongs obviously to the genus *Leidyana*, because the sporadin is solitary, the cyst dehiscences with several sporeducts and spores are barrel-shaped.

Among the members of the genus this species resembles *L. suzumushi* K. Hoshide in the size of body but it differs from the latter, in the ratio of WP : WD which is 1 : 1.4 in the latter and 1 : 1.7 in the former ; epimerite is simple globular sessile knob in the latter and elongate spatula-shaped in the former.

Gregarina blattarum Siebold 1839

1839 *Gregarina blattarum* — Siebold 1839 : 57

1953 *Gregarina blattarum* — Obata 1953 : 4

Many other references regarding this species are not shown here.

Host : *Periplaneta americana* L., *Blattela germanica* L. (by Obata, 1953)
Dictyoptera

Habitat : Intestine

Locality : Yamaguchi, Obatake (Yamaguchi Pref.)

I. Sporadin

1. Association	Biassociative.
	Stout body, more or less various in form.
2. Measurements	
2—1. Size	
Maximum	TL 650 WD 500
Average	TL 381 LP 87 LD 294 WP 109 WD 168
	tl 378 lp 50 ld 328 wp 106 wd 156
2—2. Ratio	LP : TL= 1 : 4.4 WP : WD= 1 : 1.5
	lp : tl= 1 : 7.6 wp : wd= 1 : 1.5
3. Shape	Cylindrical in young, widen and become irregularly with age.
(Primite)	
4. Protomerite	
4—1. Shape	Dome-shaped, a little wider than high, ratio of LP : WP= 1 : 1.3—1.4
5. Deutomerite	
5—1. Shape	In young : elongate cylindrical, often closed slightly at posterior portion.
	In adult : obese, broadly cylindrical, or rather ovoidal, widest at anteriorly one quarter from septum.
6. Septum	Distinct, constricts slightly.
7. Nucleus	
7—1. Shape	Spherical, 40—50μ in diameter.
7—2. Position	Unfixed but generally in middle to posterior portion.
7—3. Nucleolus	4—6.
8. Endoplasm	
8—1. Color	Dark brown.
8—2. Granules	Dense, almost the same quality in both parts, protomerite and deutomerite except at top of protomerite—almost transparent with fine granules.
9. Ectoplasm	Thick, stout.
(Satellite)	
4'. Protomerite	
4'—1. Shape	Flattened, twice as wide as high.
5'. Deutomerite	
5'—1. Shape	In young : cylindrical, rounded at posterior end.
	In adult : ovoidal, widest in anterior half, well rounded at posterior extremity.
6'. Septum	Distinct, constricted.

II. Cyst

1. Structure — Spherical or rather ellipsoidal, covered with thick transparent, gelatinous cyst cover.
200—250μ in diameter of substantial part of cyst, thickness of cover 40—60μ.

2. Dehiscence — By spore ducts, 6—12 in numbers, 150μ in length, reach outside of transparent cover, discharge spores in chain.

III. Spore

1. Shape — Cylindrical to barrel-shaped, trancated at ends, 8×2.5μ.

IV. Movement — Gliding and bending actively.

V. Cephalin

3. Epimerite — Simple hyaline knob.

Table 2. *Gregarina blattarum* Siebold
Measurements and Ratio of Sporadins (unit μ)

Total length of association	1247	956	812	772	718
Primite					
TL	603	478	354	252	322
LP	135	83	83	67	73
LD	468	395	271	185	249
WP	239	125	104	95	104
WD	489	177	156	157	146
Ratio					
LP : TL	1 : 4.5	1 : 5.7	1 : 4.3	1 : 3.8	1 : 4.4
WP : WD	1 : 2.0	1 : 1.4	1 : 1.5	1 : 1.7	1 : 4.4
Satellite					
tl	645	478	458	540	395
lp	83	52	31	56	42
ld	562	425	427	484	353
wp	260	I35	83	95	94
wd	437	177	I14	118	125
Ratio					
lp : tl	1 : 7.8	1 : 9.1	I : 14.8	1 : 9.6	1 : 9.4
wp : wd	1 : 1.7	1 : 1.3	1 : 1.4	1 : 1.3	1 : 1.3

Gregarina inago H. Hoshide 1958

1958 *Gregarina inago* H. Hoshide 1958 : 45

Host : *Oxya velox* Fabricius, *Oxya japonicus* Willesme, Orthoptera, Locustidae

Habitat : Intestine

Locality : Obatake, Yamato, Hikari (Yamaguchi Pref.)

I. Sporadin

1. Association	Biassociative, rarely triassociative.
2. Measurements	Maximum length of association 810μ.
2—1. Size	
Maximum	TL 410 WD 290
Average	TL 344 LP 105 LD 239 WP 128 WD 250
	tl 318 lp 47 ld 269 wp 172 wd 235
2—2. Ratio	LP : TL= 1 : 3.3 WP : WD= 1 : 2.0
	lp : tl= 1 : 6.8 wp : wd= 1 : 1.4
3. Shape	Obese, almost ovoidal to subglobular.
(Primite)	
4. Protomerite	
4—1. Shape	Dome-shaped, slightly wider than high, widest at near base, rather obtuse at apex.
5. Deutomerite	
5—1. Shape	Subglobular, widest in middle or slightly below middle, narrowing gradually from the widest part and ending in broadly rounded posterior extremity.
6. Septum	Distinct, constriction deep.
7. Nucleus	Its shape and position in large dense sporadin in vivo not visible ; when fixed and stained with any dyes visible.
7—1. Shape	Spherical, 30—40μ in diameter.
7—2. Position	Generally placed at anterior region or middle of deutomerite.
7—3. Nucleolus	Many, small.
(Satellite)	Interlocking device between primite and satellite well developed, the posterior end of primite contact tightly with primite which is received in the concave depression of the anterior end of satellite.
4'. Protomerite	
4'—1. Shape	Pressed and flattened at top and base ; three or four times as wide as high. Thick small lens-shaped area observed at apex.
5'. Deutomerite	
5'—1. Shape	Subglobular, maximum width at anterior third of deutomerite or at its middle. Posterior end broadly rounded or somewhat concave with arc upward with small indentation at its center.
6'. Septum	Constriction deep.
7'. Nucleus	Characters almost as same as that of primite.

8. Endoplasm — Much more dense and opaque than that of many other gregarines.

8—1. Color — Protomerite reddish orange, deutomerite slightly lighter than protomerite.

9. Ectoplasm — Stout, very thick, 20μ in thickness in well mature sporadins except at its septum, longitudinal fine striation well observed.

II. Cyst

1. Structure — Spherical, 410μ in average diameter, covered with thick two envelopes ; outer one thickly gelatinous 50-90μ in thickness, inner one transparent, 5—7 μ in thickness.

2. Dehiscence — By three or two long spore ducts, each one about 800μ in length, spores extruded in chains.

III. Spores

1. Shape — Barrel-shaped.

2. Size — 4 x5.5μ

IV. Movement — Fairly active as in other gregarines from Orthoptera.

V. Cephalin

1. Shape — Ovoidal.

2. Structure — Ectocyte already well developed in fairly small cephalins.

3. Epimerite — Small globular, hyaline as in other normal members of genus *Gregarina*.

Gregarina acantholobae H. Hoshide 1952

1952 *Gregarina acantholobae* H. Hosshide 1952 : 117

Host : *Acantholobus japonicus* de Haan Orthoptera, Tettigidae

Habitat : Intestine

Locality : Yamaguchi, Obatake, Yanai (Yamaguchi Pref.)

I. Sporadin

1. Association — Biassociative, maximum length 500μ. Association seen in early stage.

2. Measurements

2—1. Size

Maximum — TL 270 WD 115

Average — TL 184 LP 42 LD 142 WP 51 WD 94
tl 160 lp 155 wp 59 wd 93

2—2. Ratio — LP : TL= 1 : 4.4 WP : WD= 1 : 1.8
lp : tl= 1 : 32 wp : wd= 1 : 1.6

3. Shape — Elongate ovoidal.

(Primite)

4. Protomerite

4—1. Shape — Dome-shaped, sometimes some pentagonal. Widest at base, slightly wider than high.

5. Deutomerite

5—1. Shape — Elongate ovoidal. Widest at posterior portion, broadly rounded extremity.

6. Septum — Distinct, constriction at septum.

7. Nucleus

7—1. Shape — Spherical, 20—25 μ in diameter.

7—2. Position — Unfixed but generally in anterior region of deutomerite.

7—3. Nucleolus — Spherical, one.

8. Endoplasm

8—1. Color — Brownish yellow, but paler in protomerite than in deutomerite.

8—2. Granules — Fine, uniformally.

9. Ectoplasm — Epicyte very thick at anterior end of primite protomerite.

Gregarina concava H. Hoshide 1952

1952 *Gregarina concava* — H. Hoshide 1952 : 114

Host : *Gampsocleis burgeri* de Haan — Orthoptera, Tettigoniidae

Habitat : Gastric caeca, intestine

Locality : Hikari, Obatake, Yamaguchi (Yamaguchi Pref.)

I. Sporadin

1. Association — Biassociative, maximum length 950μ.

2. Measurements

2—1. Size

Maximum — TL 520 WD 200

Average — TL 355 LP 96 LD 259 WP 118 WD 134
tl 320 lp 61 ld 259 wp 92 wd 116

2—2. Ratio — LP : TL= 1 : 3.6 WP : WD= 1 : 1.1
lp : tl= 1 : 5.2 wp : wd= 1 : 1.3

3. Shape — Ellipsoidal to cylindrical, satellite often less longer than primite.

(Primite)

4. Protomerite

4—1. Shape — Short cylindrical, slightly wider than high, central portion widest, top concaves with wavy margin and swollen cone at bottom.

5. Deutomerite

5—1. Shape — Ellongate ovoidal, widest near septum, tapering from here and ending in rather rounded posterior extremity.

6. Septum — Distinct, fairly deep constriction.

7. Nucleus

7—1. Shape — Spherical, 30μ in average diameter.

7—2. Position — Unsettled, not visible in dense adults in vivo.

7—3. Nucleolus — 1—3.

8. Endoplasm

8—1. Color — Yellowish brown but blackish in protomerite.

8—2. Granules — Very dense in both protomerite and deutomerite, those in the former somewhat larger and less than in the latter.

9. Ectoplasm — Fairly thick throughout body, especially very thick at anterior end, fine longitudinal striations in epicyte.

(Satellite)

4'. Protomerite

4'—1. Shape — Compressed, Shallow anterior concave connects with end of primite, width 1.2—2 times as long as height.

5'. Deutomerite

5'—1. Shape — Ovoidal, a little wider than Protomerite, widest at middle, well rounded at posterior end.

II. Cyst

1. Structure — Opaque yellowish brown in color, two coverings, outer one 40—50μ in thickness, gelatinous, with concentric fine lines ; innor one 10μ in thickness, transparent clear.

2. Dehiscence — By sporeducts, 5—6 in number, each duct very long : 800—1000μ, spores discharged in chain.

III. Spore

1. Shape — Barrel-shaped with very small spines at both ends.

2. Size — 4 x 3 μ

V. Cephalin

1. Shape — Youngest one, subspherical, 15μ in length.
Fairly grown up one ovoidal, body partitioned into three parts ; epimerite, protomerite, deutomerite.

2. Structure — Anterior region of protomerite hyaline, varies its shape by contructing or expanding.

3. Epimerite — Small spherical papilla without stalk.

Gregarina scapsipedae H. Hoshide 1958

1958 *Gregarina scapsipedae* H. Hoshide 1958 : 48

Host : *Scapsipedus asperus* Walker Orthoptera ,Gryllidae
Habitat : Intestine
Locality : Yamato (Yamaguchi Pref.)

I. Sporadin

1. Association — Biassociative. Maximum length of association 579μ.

2. Measurements

2—1. Size

Maximum — TL 235 WD 130

Average — TL 177 LP 47 LD 130 WP 87 WD 79
tl 201 lp 55 ld 146 wp 62 wd 75

2—2. Ratio — LP : TL= 1 : 3.8 WP : WD= 1 : 0.9
lp : tl= 1 : 3.7 wp : wd= 1 : 2.0

3. Shape — Primite nearly ovoidal, satellite ellipsoidal.

(Primite)

4. Protomerite

4—1. Shape — Low, broad, flat or slightly concaved at apex, about twice as wide as high, usually a little wider than deutomerite.

5. Deutomerite

5—1. Shape — Nearly ovoidal, widest at short distance below shoulder or at about shoulder, tapering from here to broadly rounded posterior extremity.

6. Septum — Distinct, constriction very deep.

7. Nucleus

7—1. Shape — Spherical, 25μ in diameter, about one-third to one-fourth of the width of deutomerite.

7—2. Position — Not fixed.

7—3. Nucleolus — Several, those are small.

(Satellite)

4'. Protomerite

4'—1. Shape — Short cylindrical, flattened at top and bottom, width about equal its height or slightly wider than long.

5'. Deutomerite

5'—1. Shape — Elongate ovoidal, widest a little below shoulder.

6'. Septum — Distinct, fairly deep.

7'. Nucleus — Characters of satellite nucleus are about as same as those of primite nucleus.

8. Endoplasm

8—1. Color — Dark brown, almost opaque in mature sporadins.

8—2. Granules — In protomerite less dense and coarse than in deutomerite.

9. Ectoplasm — Rather thick, of even width throughout body, longitudinal fine striations observed well.

II. Cyst

1. Structure — Spherical, 190—250μ in diameter, covering of cyst thin, transparent, about 15μ in thickness measured when it is just after the cyst is formed.

2. Dehiscence — By 3—5 sporeducts from which spores are extruded in chains.

III. Spore

1. Shape — Barrel-shaped.

2. Size — 2 x 5 μ

Gregarina arietuliae n. sp.

Host : *Loxoblemmus arietulus* Sauss — Orthoptera, Gryllidae

Habitat : Intestine

Locality : Yamaguchi, Nishikicho, Obatake (Yamaguchi Pref.)

I. Sporadin

1. Association — Biassociative, maximum length of association 634μ.

2. Measurements

2—1. Size

Maximum — TL 312 LP 52 LD 260 WP 155
tl 322 lp 52 ld 270 wp 120 wd 155

Average — TL 225 LP 55 LD 170 WP 119 WD 123
tl 228 lp 52 ld 176 wp 91 wd 128

2—2. Ratio — LP : TL= 1 : 4.1 WP : WD= 1 : 1.0
lp : tl= 1 : 4.4 wp : wd= 1 : 1.4

3. Shape — Primite ovoidal, satellite ellipsoidal.
Generally a little longer than primite, in some specimens satellite becomes globular.

(Primite)

4. Protomerite

4—1. Shape — Broad, low, concaved at apex, in some specimens anterior margin of protomerite incised like flower petals, opened anteriorly about twice as wide as high, widest near anterior end.
Always wider than that of satellite.

5. Deutomerite — Ovoidal, widens suddenly from septum, widest a short distance below septum, tapering gradually from widest portion to rotundate posterior extremity.

6. Septum	Conspicuous, fairly deep constriction at septum.
7. Nucleus	
7—1. Shape	Spherical 20—25μ in diameter.
7—2. Position	Not fixed but in many, is almost at middle of deutomerite. In well matured sporadins position of nucleus indiscernible in living stage because of its dense endoplasm.
7—3. Nucleolus	One.
(Satellite)	
4'. Protomerite	Considerably narrower than that of primite, fairly flattened, widest at about middle, shallow dish-like depression on anterior end of satellite fitting in with posterior rounded end of primite.
5'. Deutomerite	
5'—1. Shape	Ellipsoidal, widest part in middle but of approximately same width throughout deutomerite, well rounded at posterior extremity.
6'. Septum	Conspicuous, constriction deep.
7'. Nucleus	Characters almost as same as that of primite.
8. Endoplasm	
8—1. Color	Light brown.
8—2. Granules	Dense, those of both protomerite and deutomerite almost same in quality, excepting anterior region of protomerite, fine and dilute.
9. Ectoplasm	Comparatively thin.
II. Cyst	
1. Structure	Spherical, average 255μ in diameter, covered with two membranes ; outer one gelatinous thick 25—30μ in thickness, inner one transparent thin. Substantial inner part dense, brownish in color.
2. Dehiscence	By 8—10 sporeducts, each 250μ in average length swollen at basal portion. spores discharged in chain.
III. Spore	
1. Shape	Barrel-shaped.
2. Size	4.5x2.5μ
IV. Movement	Sliding and actively contorting body.
V. Cephalin	
1. Shape	Ovoidal to ellipsoidal.
2. Structure	Endoplasm scanty, almost transparent.

3. Epimerite — Hyaline small papilla.

Remarks :

Among the members of the genus *Gregarina*, this species closely resembles *G. galliveri* Watson 1915, *G. korogi* H. Hoshide 1952 and *G. concava* H. Hoshide 1952 in some respects.

This species differs from them in the points as follows : shape of protomerite of primite is flattened at apex, 4 times as wide as high in *G. galliveri* but concaved or incised like flower petals in this species ; cysts dehiscence by 2—3 sporeducts in *G. korogi*, by 5—6 sporeducts in *G. concava*, and each sporeduct of them is very long 800—1000μ in length but by 8—10 sporeducts and each is only 250μ in this species.

Gregarina parva n. sp.

Host : *Pteronemobius taprobanensis* Walker — Orthoptera, Gryllidae
Habitat : Intestine, gastric caeca
Locality : Yamaguchi, Iwakuni (Yamaguchi Pref.)

I. Sporadin

1. Association — Biassociative, maximum length of association 250μ.

2. Measurements

2—1. Size

Maximum — TL 113 LP 24 LD 89 WP 57 WD 50
tl 135 lp 25 ld 110 wp 45 wd 60

Average — TL 78 LP 19 LD 59 WP 43 WD 33
tl 89 lp 18 ld 71 wp 34 wd 42

2—2. Ratio — LP : TL= 1 : 4.1 WP : WD= 1 : 0.8
lp : tl= 1 : 4.9 wp : wd= 1 : 1.2

3. Shape — Ovoidal to ellipsoidal.

(Primite)

4. Protomerite

4—1. Shape — Depressed spheroidal, widest through middle, almost flattened or often concave at apex, irregularly wavy or saw-toothed at its anterior margin.
Generally wider than deutomerite.

5. Deutomerite

5—1. Shape — Ovoidal to cylindrical, widest a little below septum, sometimes narrow through middle, broadly rounded at posterior end.

6. Septum — Constriction deep.

7. Nucleus

7—1. Shape	Spherical, 15μ in average diameter.
7—2. Position	Not fixed, but generally near middle of deutomerite.
7—3. Nucleolus (Satellite)	One.
4'. Protomerite	
4'—1. Shape	Somewhat flattened, pressed top and bottom, width generally twice the height.
5'. Deutomerite	
5'—1. Shape	Ovoidal to elongate ovoidal, ending in a broadly rounded extremity.
8. Endoplasm	
8—1. Color	Yellowish brown
8—2. Granules	Coarse and large in both protomerite and deutomerite, except the anterior region of protomerite which has no large granules.
9. Ectoplasm	Thin, uniform of thickness all over body surface.
II. Cyst	
1. Structure	Spherical, about 50μ in diameter, covered with two different membranes ; outer one gelatinous, 10—13μ in thickness, inner one thin, transparent.
III. Spore	Not observed.
IV. Movement	Active, quickly sliding forward ; bending of the anterior region of body usually observed, especially flexible at a little below region from septum.
V. Cephalin	
1. Shape	Ovoidal, protomerite often flattened or concaved at apex, deutomerite ovoidal ending in a broadly rounded or flattened square cornered extremity.
2. Structure	Wavy or saw-toothed anterior margin of protomerite well discernible.
3. Epimerite	Small spherical knob, hyaline,

Remarks :

This parasite resembles *Gregarina concava* H. Hoshide, *G. korogi* H. Hoshide and *G. arietuliae* in this paper, in the shape of sporadins, and differs as follows : average length of primite is 355μ in *G. concava*, 163μ in *G. korogi*, 225μ in *G. arietuliae* ; this is only 78μ in *G. parva*.

This species resembles *G. kingi* Crawley 1907 in the size of sporadin but the former differs from the latter ; the primite protomerite of *G. kingi* is dilated anteriorly and constricted at or below the middle but that of *G. parva* is depressed spheroidal, widest through middle, irregularly wavy or saw-toothed at its anterior margin.

Gregarina diestrammenae H. Hoshide 1953

1953 *Gregarina diestrammenae* H. Hoshide 1953 : 36

Host : *Diestrammena japonica* Kerni Orthoptera, Stenopelmatidae
Habitat : Intestine
Locality : Obatake, Tabuse (Yamaguchi Pref.)

I. Sporadin

1. Association	Biassociative.
2. Measurements	Maximum length of association observed 1500μ.
2—1. Size	
Maximum	TL 870 WD 270
Average	TL 601 LP 131 LD 470 WP 161 WD 284
	tl 576 lp 63 ld 513 wp 215 wd 272
2—2. Ratio	LP : TL= 1 : 4.6 WP : WD= 1 : 1.8
	lp : tl= 1 : 9.1 wp : wd= 1 : 1.3
3. Shape	Ovoidal, obese in mature sporadin ; much more slender in young stage of sporadin.
(Primite)	
4. Protomerite	
4—1. Shape	Subglobular, usually wider than long, widest just above base, well rounded at apex.
5. Deutomerite	
5—1. Shape	Cylindrical to ellipsoidal, widens rapidly at shoulder, widest at or just above posterior end but almost same width throughout deutomerite, posterior extremity broadly rounded or rather truncated.
6. Septum	Conspicuous, constriction deep ; at the central position of septum protomerite concaves downward and a wedge shaped projection observed here.
7. Nucleus	
7—1. Shape	Spherical to ovoidal, 40—50μ in diameter.
7—2. Position	Not fixed, but generally in anterior region of deutomerite.
7—3. Nucleolus	3—6, spherical.
(Satellite)	The interlocking device between primite and satellite is well developed ; the end of primite fits into the shallow cavity at the anterior end of satellite.
4′. Protomerite	Flattened discoidal shape, pressed at top and bottom, three to five times as wide as high.
5′. Deutomerite	Ovoidal, widest at shoulder, tapering gradually from

shoulder to well rounded posterior end.

8. Endoplasm

8—1. Color — Yellowish orange.

8—2. Granules — Dense, homogeneous, finely granular in both protomerite and deutomerite.

9. Ectoplasm — Stout, much more resistant than in other members of gregarines ; well developed especially so at sarcocyte of deutomerite, about 25μ in thickness, but in protomerite it is rather normally thick.

II. Cyst

1. Structure — Spherical, 600—800μ in diameter, cyst's envelopes are two : outer one thick, gelatinous stratified 120—140μ in thickness, inner one thin, transparent 8—15μ in thickness.

2. Dehiscence — By 2—3 long sporeducts which are 1.7 to 2mm in length and 12μ in diameter ; spores discharged in chains.

III. Spore

1. Shape — Cylindrical with small cup-shaped projection on each end.

2. Size — 7 x 4 μ

IV. Movement — Fairly active

V. Cephalin

1. Shape — Small cephalin about 50μ in body length is ovoidal in shape ; with growth body becomes elongate cylindrical in outline.

2. Structure — Color lighter than sporadin but often small individuals form association ; the smallest association found is 250μ in length.

3. Epimerite — Simple spherical hyaline knob with a short stalk.

Gregarina monoducta H. Hoshide 1953

1953 *Gregarina monoducta* — H. Hoshide 1953 : 166

Host : *Diestrammena japonica* Kerny — Orthoptera, Stenopelmatidae

Habitat : Intestine

Locality : Obatake, Tabuse (Yamaguchi Pref.)

I. Sporadin

1. Association — Biassociative.

2. Measurements — Largest association discovered 1052μ in length, smallest one 170μ in length.

2—1. Size

Maximum — TL 530

Average	TL 448 LP 162 LD 286 WP 384 WD 328 tl 444 lp 137 ld 307 wp 301 wd 328
2—2. Ratio	LP : TL= 1 : 2.8 WP : WD= 1 : 0.9 lp : tl= 1 : 3.2 wp : wd= 1 : 1.1
3. Shape	Obese, broadly ovoidal to subglobular. Primite usually longer and larger than satellite.
(Primite)	
4. Protomerite	
4—1. Shape	Roughly broadly discoidal, width about 2 to 2.5 times its length, anterior end rather flattened or slightly concave at its center, generally widest near anterior extremity.
5. Deutomerite	
5—1. Shape	Subglobular to ovoidal, widest at middle from here narrows toward posterior end, terminating at broadly rounded extremity.
6. Septum	Distinct, constriction deep.
7. Nucleus	
7—1. Shape	Spherical or ellispoidal in some specimens. 70μ in average diameter.
7—2. Position	Not fixed, position and outline of nucleus obscure in dense adult sporadins.
7—3. Nucleolus	Many small.
(Satellite)	
4′. Protomerite	Interlocking device well developed, boundary face between primite and satellite broad.
4′—1. Shape	Almost flattened top and bottom, slightly depressed at apex to receive the posterior end of primite, about 2 times as wide as long, widest at middle.
5′. Protomerite	
5′—1. Shape	Ovoidal, widest at shoulder, tapering from here to broadly rounded posterior end.
6′. Septum	Distinct but not so deep as primite.
8. Endoplasm	
8—1. Color	Protomerite dark orange, deutomerite yellowish orange.
8—2. Granules	Glanules of protomerite a little larger than those of deutomerite.
9. Ectoplasm	Rather thin, slightly wavy all over the surface of body.
II. Cyst	
1. Structure	Spherical, 400—550μ in diameter, envelope of cyst

	double : outer one thick gelatinous, 40—70μ in thickness, inner one thin hyaline, 5 — 8 μ in thickness.
2. Dehiscence	By one long sporeduct, 2.5—2.8mm in length, 20μ in diameter ; spores extruded from it in chains.
III. Spore	
1. Shape	Cylindrical, 3 ×1.2μ.
IV. Movement	Fairly active.
V. Cephalin	
1. Shape	The smallest found 28μ in length, Subglobular. It gradually increases in length and width with age and becomes ovoidal in shape. Fairly developed cephalin, changing its body form to elongate cylindrical.
2. Structure	The smallest one almost transparent but as it grows larger endoplasm increases.
3. Epimerite	Small spherical.

Coronoepimeritus japonicus H. Hoshide 1958

1958 *Coronoepimeritus japonicus* H. Hoshide 1958 : 63

Host : *Locusta migratoria danica* L., *Oxya japonicus* Willesme, *Oedaleus infernalis* de Saussure, *Oxya velox* Fabricius Orthoptera, Locustidae

Habitat : Intesine, gastric caeca

Locality : Various districts in Yamaguchi and Hiroshima Pref.

I. Sporadin	
1. Association	Solitary
2. Measurements	
2—1. Size	
Maximum	TL 1200 WD 450
Average	TL 1020 LP 128 LD 892 WP 280 WD 335
2—2. Ratio	LP : TL= 1 : 8.0 WP : WD= 1 : 1.2
3. Shape	Elongate ovoidal.
4. Protomerite	
4—1. Shape	Dome-shaped, widest a little above base. About twice as wide as high, broadly rounded at anterior end. Small conical projection often observed at anterior center of protomerite.
5. Deutomerite	
5—1. Shape	Elongate ovoidal, widest at a short distance below shoul-

	der tapering to a bluntly pointed posterior end.
6. Septum	Distinct but constriction here apparently none or vague.
7 Nucleus	
7—1. Shape	Spherical or somewhat ovoidal, 90μ in average diameter, nearly half the width of deutomerite.
7—2. Position	Not fixed, often not visible in dense mature sporadins.
7—3. Nucleolus	10 or more in numbers, small spherical.
8. Endoplasm	
8—1. Color	Light or dark brown.
8—2. Granules	Finely granular in both protomerite and deutomerite, dense and opaque in deutomerite but less dense in protomerite.
9. Ectoplasm	Very thick, more than 20μ in thickness.
II. Cyst	
1. Structure	Opaque, pearly white spherule, 650—1050μ in diameter. Cyst wall, 115—195μ in thickness, composed of two different membranes : inner one thin, transparent, no-structure, outer one thick, gelatinous.
2. Dehiscence	By simple rupture : outer cyst membrane dissolved, inner membrane equally divided in two, extruding spores from this opening.
III. Spore	
1. Shape	Ellipsoidal with two long filament-like spines at each pole, spine about 30μ in length.
2. Size	12x 6 μ
V. Cephalin	
1. Shape	Faily large cephalin 300—500μ in length, ovoidal, adhering to host's gut wall.
2. Structure	Almost the same as mature sporadin except that its endoplasm less dense than that of sporadin.
3. Epimerite	Crown-like globular, 100x70μ in size, with short stalk, numerous digitiform small processes covered on surface of crown.

Coronoepimeritus monospinus H. Hoshide 1958

1958 *Coronoepimeritus monospinus* H. Hoshide 1958 : 67

Host : *Euconocephalus thumbergi* Stal Orthoptera, Tettigoniidae
Habitat : Intestine, gastric caeca
Locality : Obatake (Yamaguchi Pref.)

I. Sporadin

1. Association	Solitary
2. Measurements	
2—1. Size	
Maximum	TL 1400 WD 500
Average	TL 1005 LP 157 LD 848 WP 280 WD 382
2—2. Ratio	LP : TL= 1 : 6.4 WP : WD= 1 : 1.4
3. Shape	Elongate ellipsoidal to cylindrical.
4. Protomerite	
4—1. Shape	Nearly hemispherical, generally wider than high, widest at base, well rounded at apex.
5. Deutomerite	
5—1. Shape	Ovoidal to cylindrical, widest at shoulder tapering gradually from here and terminating in broadly rounded posterior end.
6. Septum	Distinct, constriction slight.
7. Nucleus	
7—1. Shape	Spherical, 80μ in average diameter.
7—2. Position	Not fixed.
7—3. Nucleolus	20 or more in number, each one spherical, small.
8. Endoplasm	
8—1. Color	Dark brown, porotomerite lighter in color than deutomerite
8—2. Granules	Dense, opaque in deutomerite, less dense in protomerite than deutomerite. Anterior small region immediately below apex nearly transparent.
9. Ectoplasm	Well developed, thick, especially at anterior end of protomerite.

II. Cyst

1. Structure	Spherical, total diameter varies 750—2000μ, this variation accords mainly with the thickness of cyst-covering which is double : inner one transparent, outer one very thick, gelatinous, grayish.
2. Dehiscence	By simple rupture

III. Spore

1. Shape	Ovoidal with long filament-like spine, 60μ in length at one end and at the other end with none
2. Size	13x 8 μ

V. Cephalin

1. Shape	Ovoidal
2. Structure	Almost the same as that of sporadin.

3. Epimerite — Large crown-like, subglobular, 90 x 70μ, furnished with many digitiform processes on its surface. Processes often branched off in several fine filaments at tip.

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Explanation of Fig.

Fig. 1.

Leidyana oviformis n. sp.

A. Sporadin matured well before cyst formation.

B. Mature sporadin moving actively and elongated its form.

C. Another type of mature sporadin.

D. Cyst with inner thin and outer thick coverings.

E. Sporeduct showing discharging spores from its opening in chain.

F. Three spores.

G. Small cephalin with spatula-form epimerite.

Gregarina inago H. Hoshide.

H. Mature association, elongated ovoidal form.

I. Other mature association.

J. well mature association showing a subglobular form.

K. An association in young stage.

L. 1. Protomerite of primite.

2. Interlocking phase between primite and satellite.

M. An association in slightly younger stage moving actively

Fig. 2.

Gregarina blattarum Siebold.

A. An association at beginning of cyst formation, sporadins are rotating.

B. A slender association.

C. D. E. F. G. Various forms of mature association.

H. Cyst after rotating movement and coverings are made.

I. Four ripe spores.

J. Cyst from which almost all ripe spores have extruded, 10 spore duct are extended from the surface of cyst.

K. A sporeduct from which spores are extruded in chains, several colored pigments are attached on the surface of sporeduct.

L. Triassociative, at the end of a primite two small satellites are sticking at the same time.

M. Anterior region of cephalin, small globular epimerite is shown.

N. Small cephalin.

O. Triassociative sporadin in lineal form.

Fig. 3.

A. B. C. D. *Gregarina concava* H. Hoshide.

After H. Hoshide. 1952, Plate.I,Figs. 1, 4 .Plate II. Figs.16, 19g.

E. F. G. *Gregarina korogi* H. Hoshide.

After H. Hoshide. 1952., Text Fig. 2 and Plate I. 9, 10.

H. I. J. *Gregarina scapsipedae* H. Hoshide.

After H. Hoshide, 1958, Plate IX, 140, 142, 143.

K. *Gregarina acantholobae* H. Hoshide.

After H. Hoshide, 1952, Plate I. 7.

L. M. N. *Gregarina monoducta* H. Hoshide.
After H. Hoshide. 1953, Figs. 1, 2, 3.
O. P. Q. *Gregarina diestrammenae* H. Hoshide.
After H. Hoshide. 1953, Figs. 1, 4, 5.
R. S. T. *Coronoepimeritus japonicus* H. Hoshide.
After H. Hoshide 1958, Plate XX. 304, 306, 309.
U. V. W. *Coronoepimeritus monospinus* H. Hoshide.
After H. Hoshide, 1958, Plate XXI, 327, 330, 331.

Fig. 4.

Gregarina arietuliae n. sp.
A. Rotating syzygy.
B. C. Mature association.
E. Small syzygy.
F. Cyst. six long sporeducts are radially extended.
G. Four spores.
H. One sporeduct enlarged. basal region is swollen tapering to very slender point from which spores are discharged in chains.

Gregarina parva n. sp.
I. Cephalin. free in lumen of intestine.
J. Small cephalin with epimerite.
K. A cyst just after cyst formation.
L. A cyst. outer and inner cyst membrane already formed.
M. N. O. Mature associations.
P. Two sporadins in the process of rotation previous to cyst formation.

Fig. 5.

Leidyana oviformis. n. sp.
A. Small cephalin with epimerite.
B. Sporadin in young stage.
C. Mature sporadin.
D. Well mature sporadin.
E. Cyst.
F. Cyst in which spores are visible.
G. H. I. Spores.

Fig. 6.

Gregarina blattarum Siebold
A. Many associations.
B. Mature association rather obese.
C. Abnormal association, one primite with two satellites.
D. Matured association.
E. Another abnormal association, three sporadins range one behind another.
F. G. H. I. Cyst with thick gelatinous membrane.

Fig. 7.

Gregarina blattarum Siebold

A. Ripe cyst with a lot of sporeducts in the process of extruding spores.

B. Enlarged view of sporeduct, a lot of semispherical projections on the surface of sporeduct.

C. Spores extruded from the cyst.

D. Magnified view of spores in chains.

E. High magnification of spore.

Fig. 8.

Gregarina inago H. Hoshide

A. B. C. Associated sporadin.

D. E. F. Association with thick ectoplasm.

G. H. Cyst.

Fig. 9.

Gregarina concava H. Hoshide

A. Large association and small cephalin.

B. Mature association.

C. Mature sporadin, association and cyst coexist.

D. Mature cyst with thick membrane.

E. Cyst.

Fig. 10.

Gregarina arietuliae n. sp.

A. B. Mature association.

C. Cyst with five sporeducts. extruding a lot of spores.

D. Mature cyst.

E. Cyst. still recognized two individuals.

F. Enlarged view of sporeduct.

G. Mature cyst with seven long sporeducts.

H. Enlarged view of sporeduct.

I. J. K. Many spores in chains.

Fig. 11.

Gregarina parva n. sp.

A. Sporadin and cyst coexist.

B. C. Mature association.

D. Cyst.

E. Mature cyst.

F. Cyst with one sporeduct.

G. Mature cyst.

H. Cyst with one sporeduct.

Fig. 1.

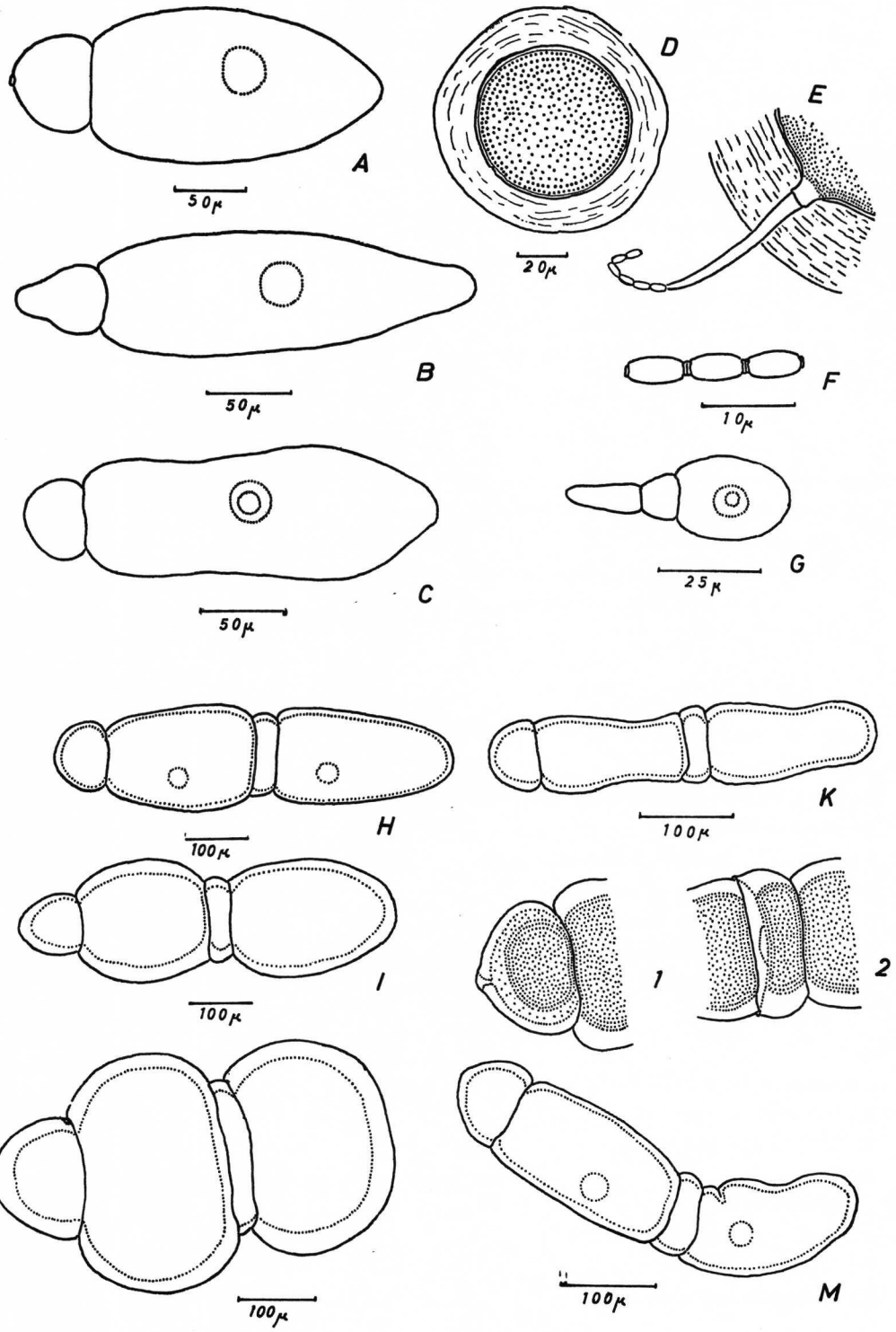
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Fig. 2.

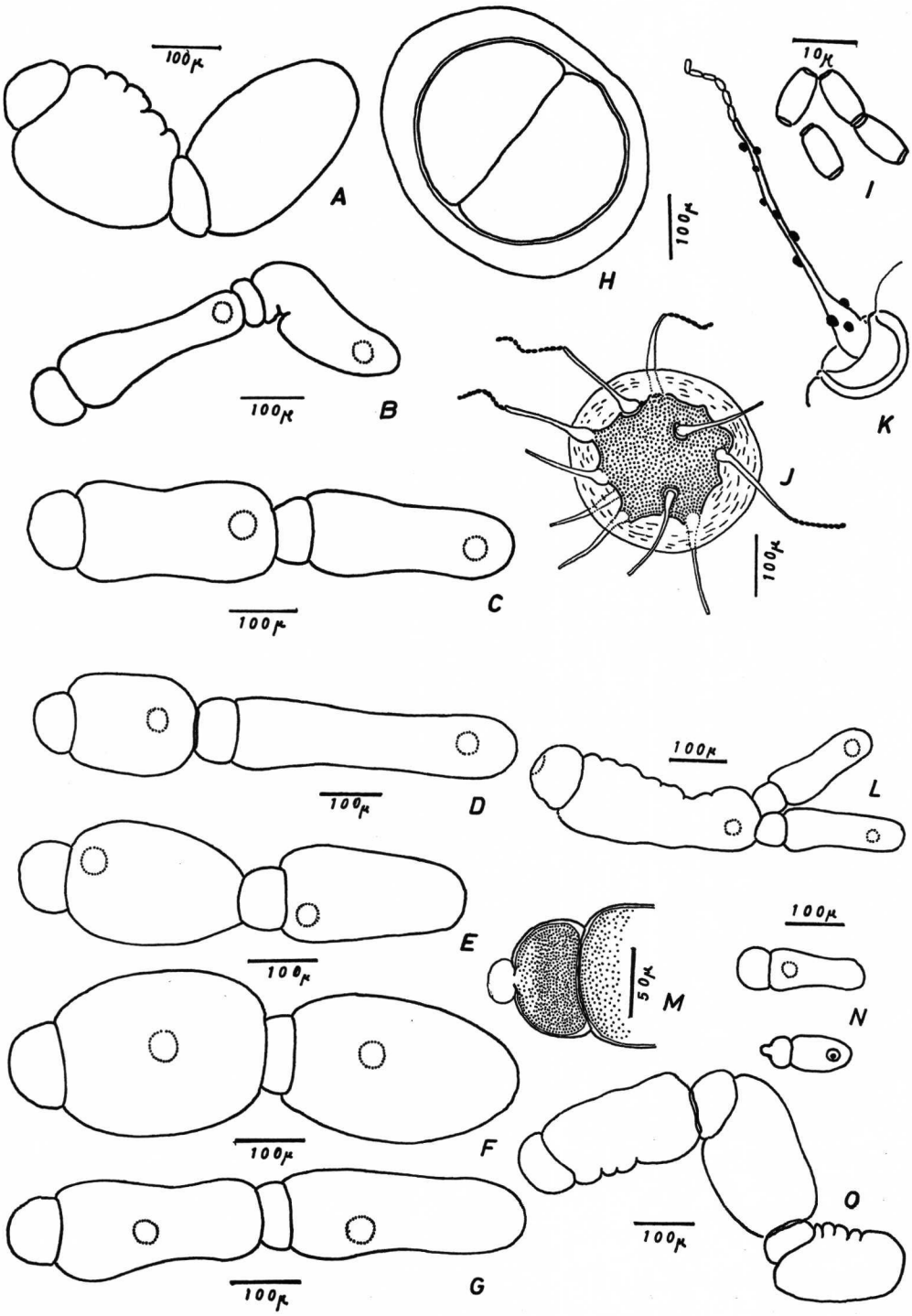
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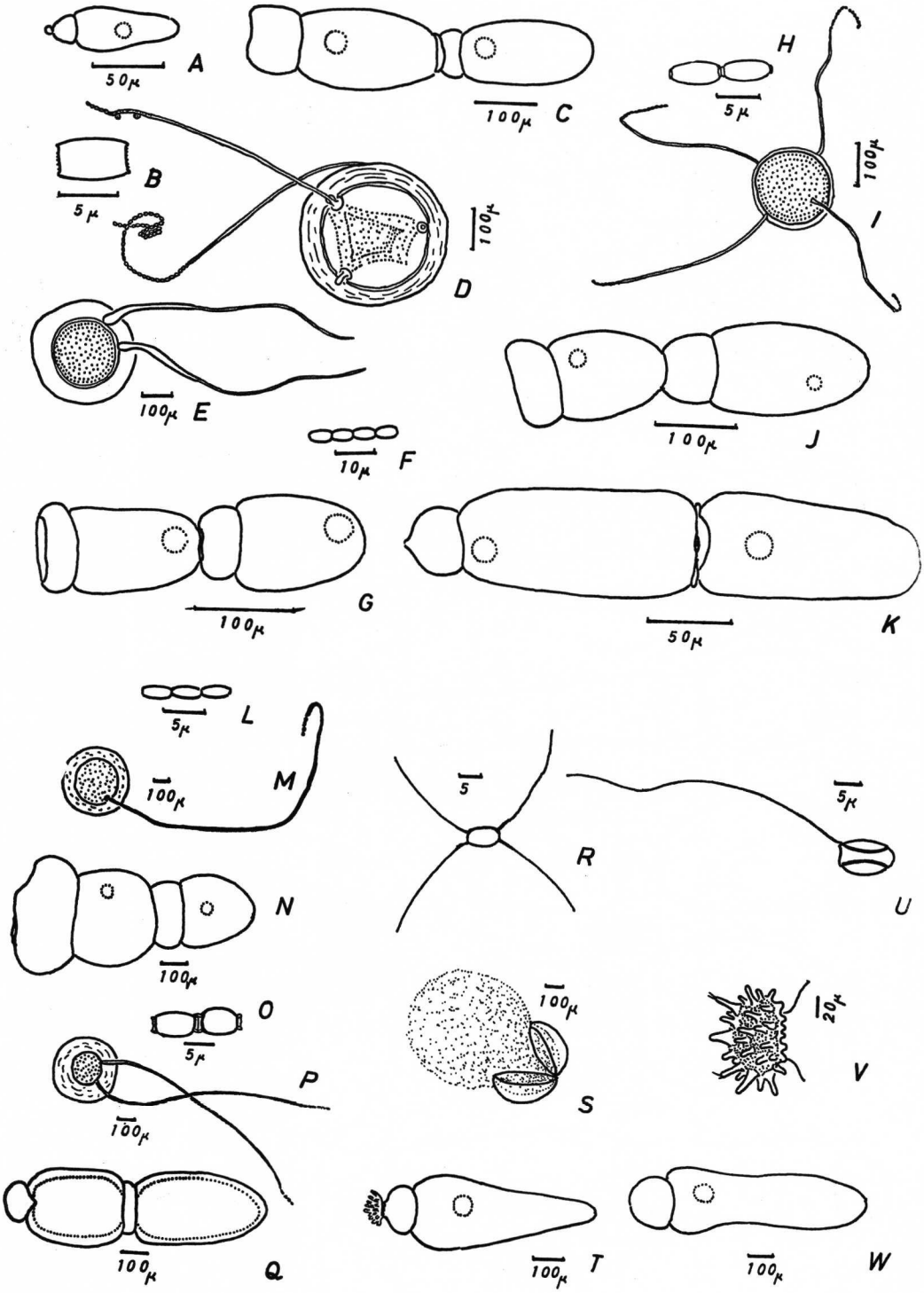
Fig. 3.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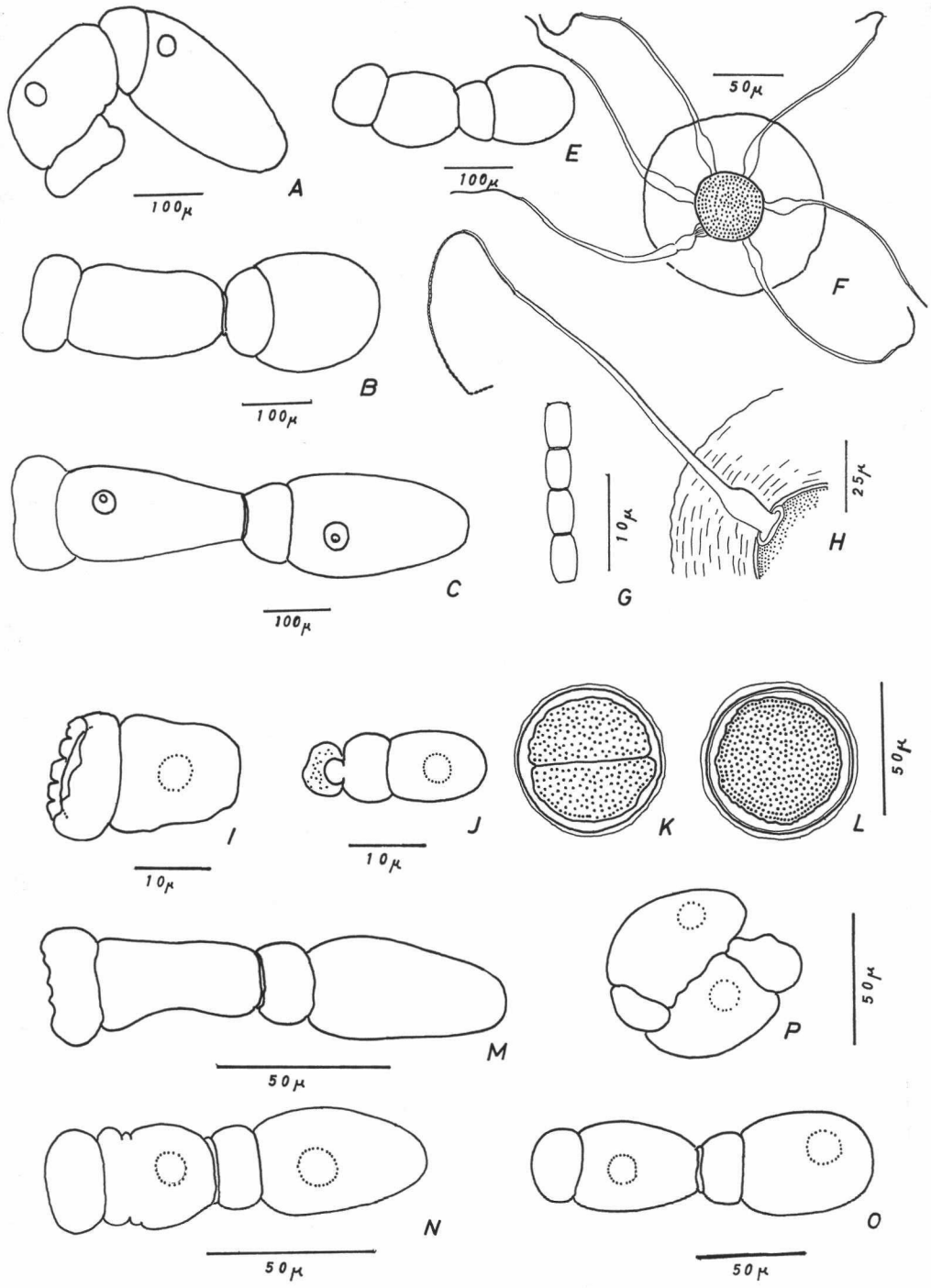
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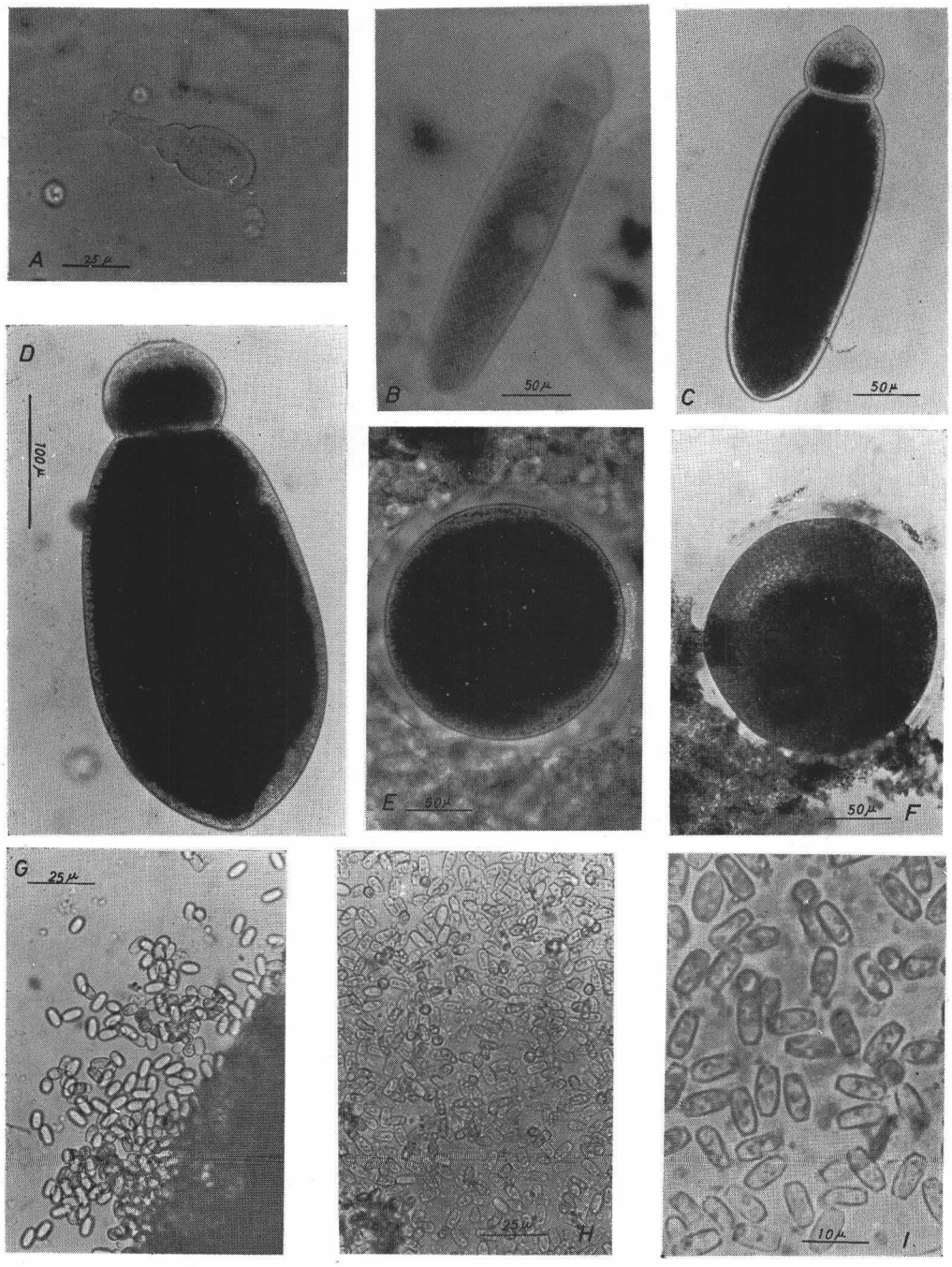
Fig. 5.



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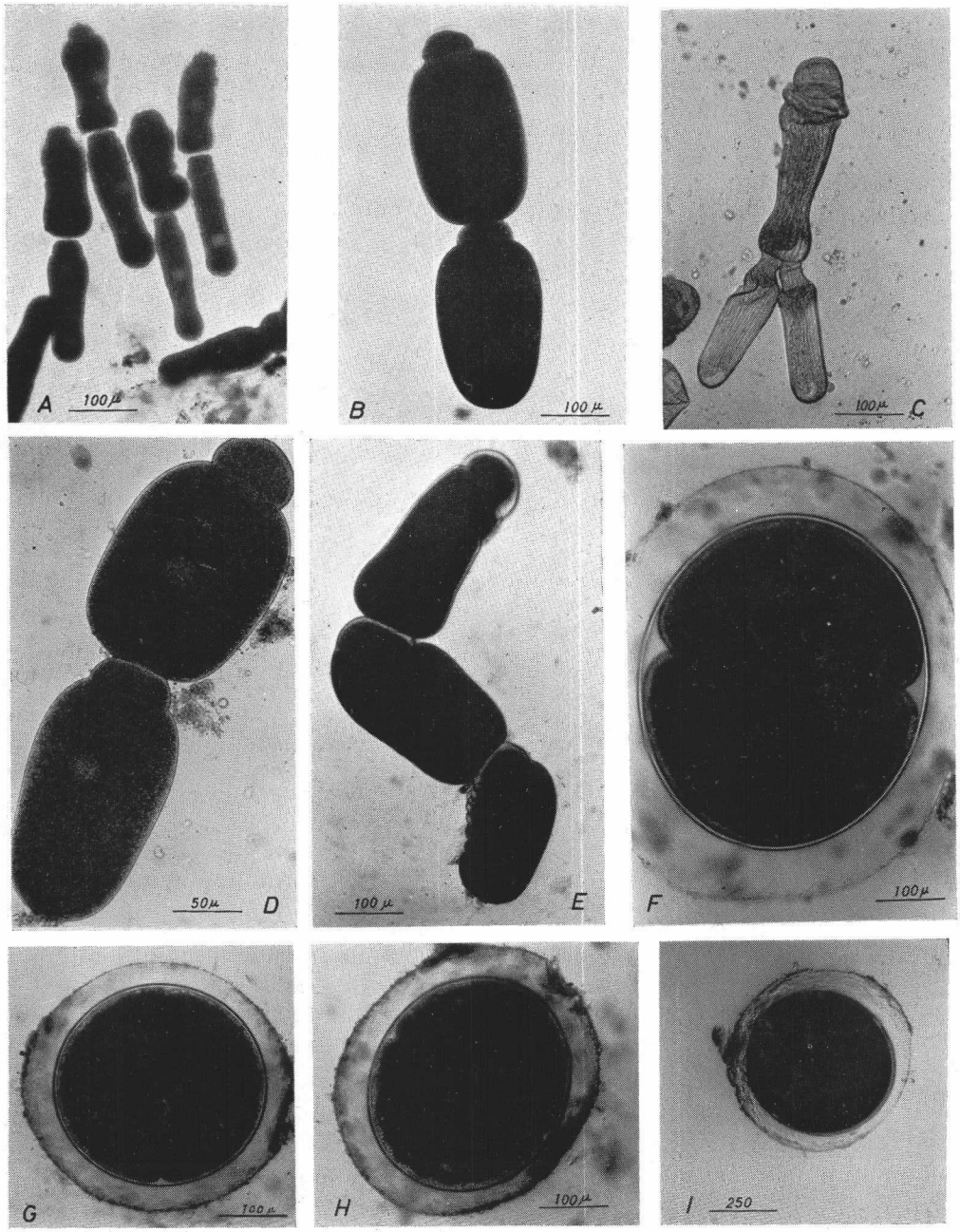

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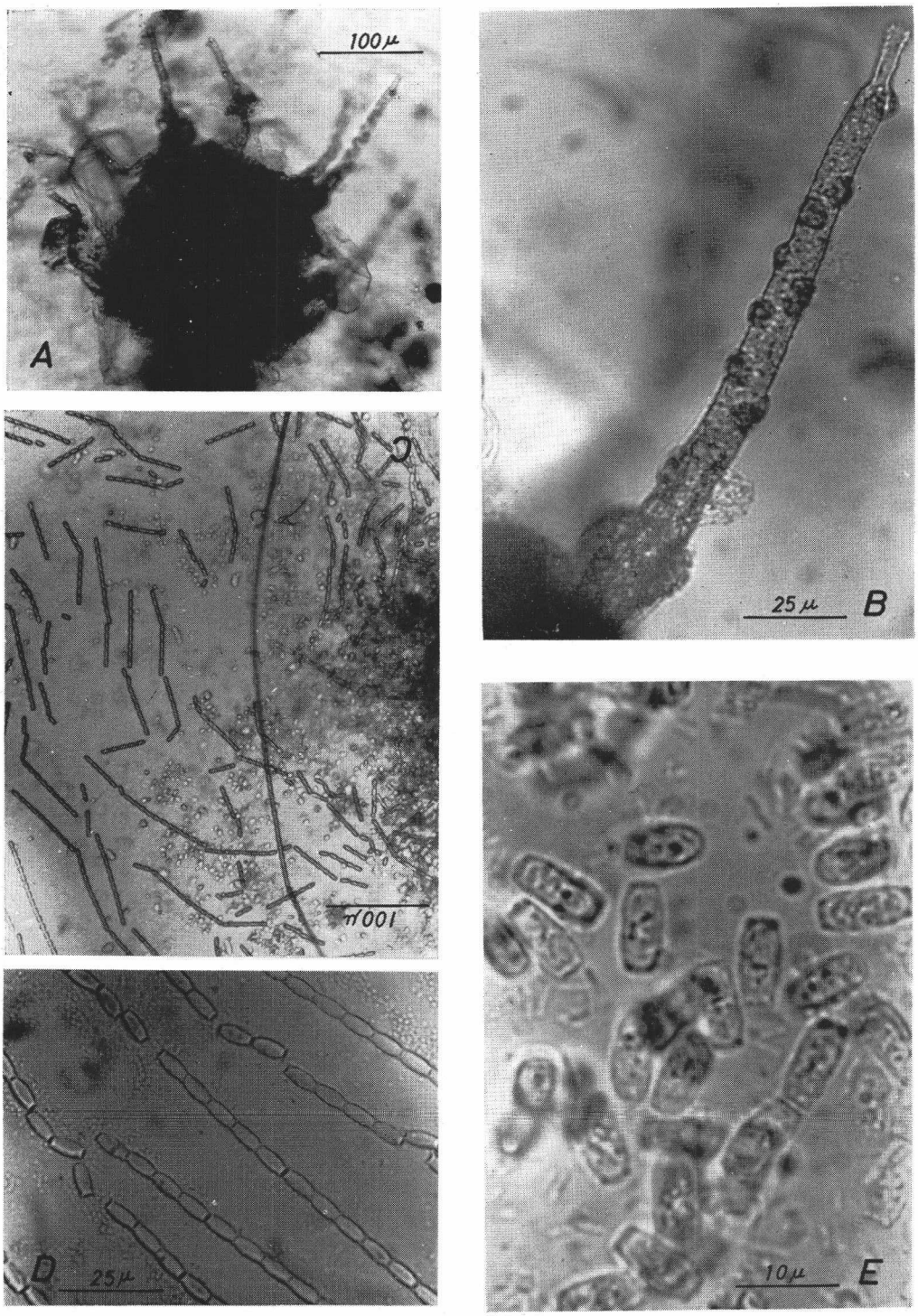

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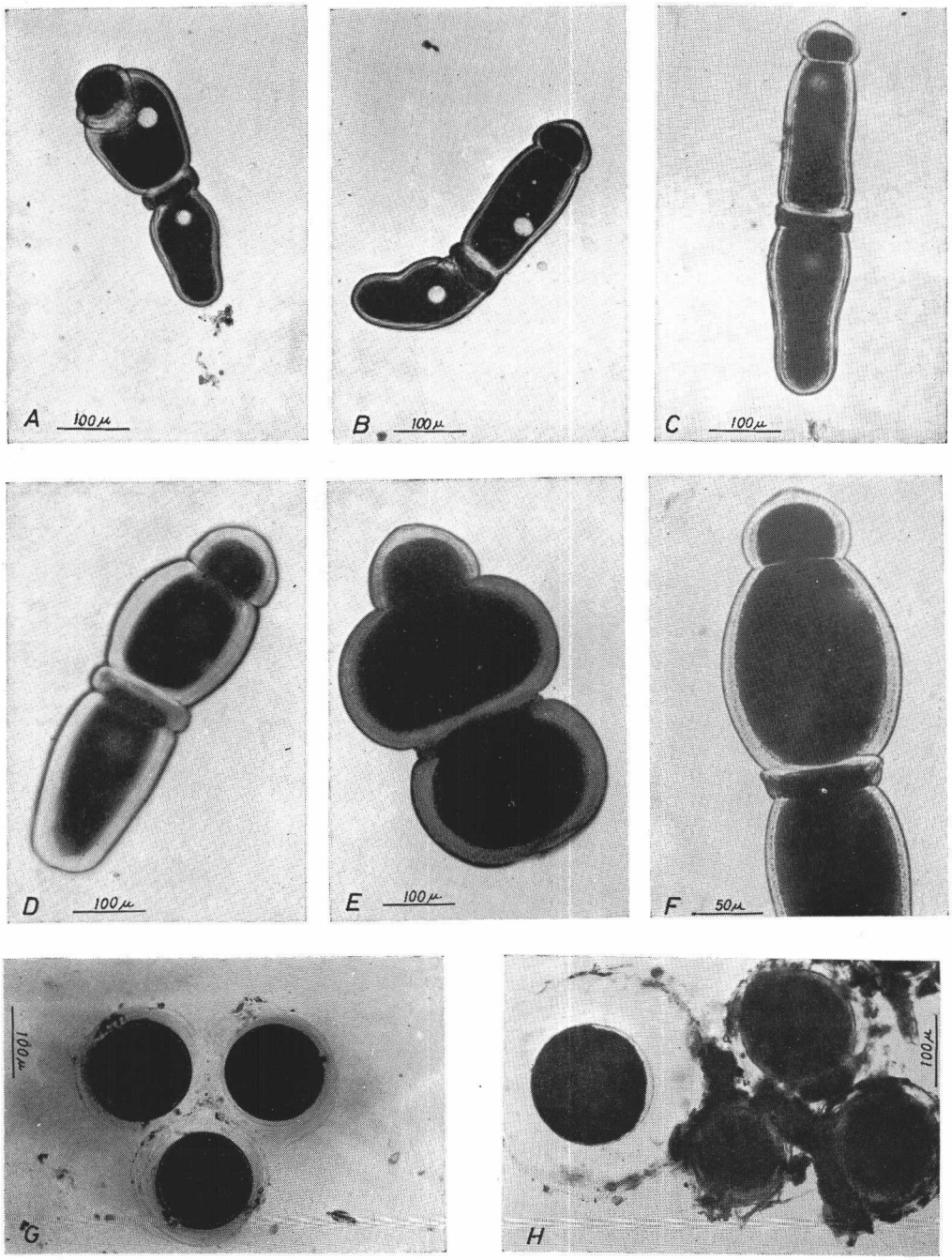

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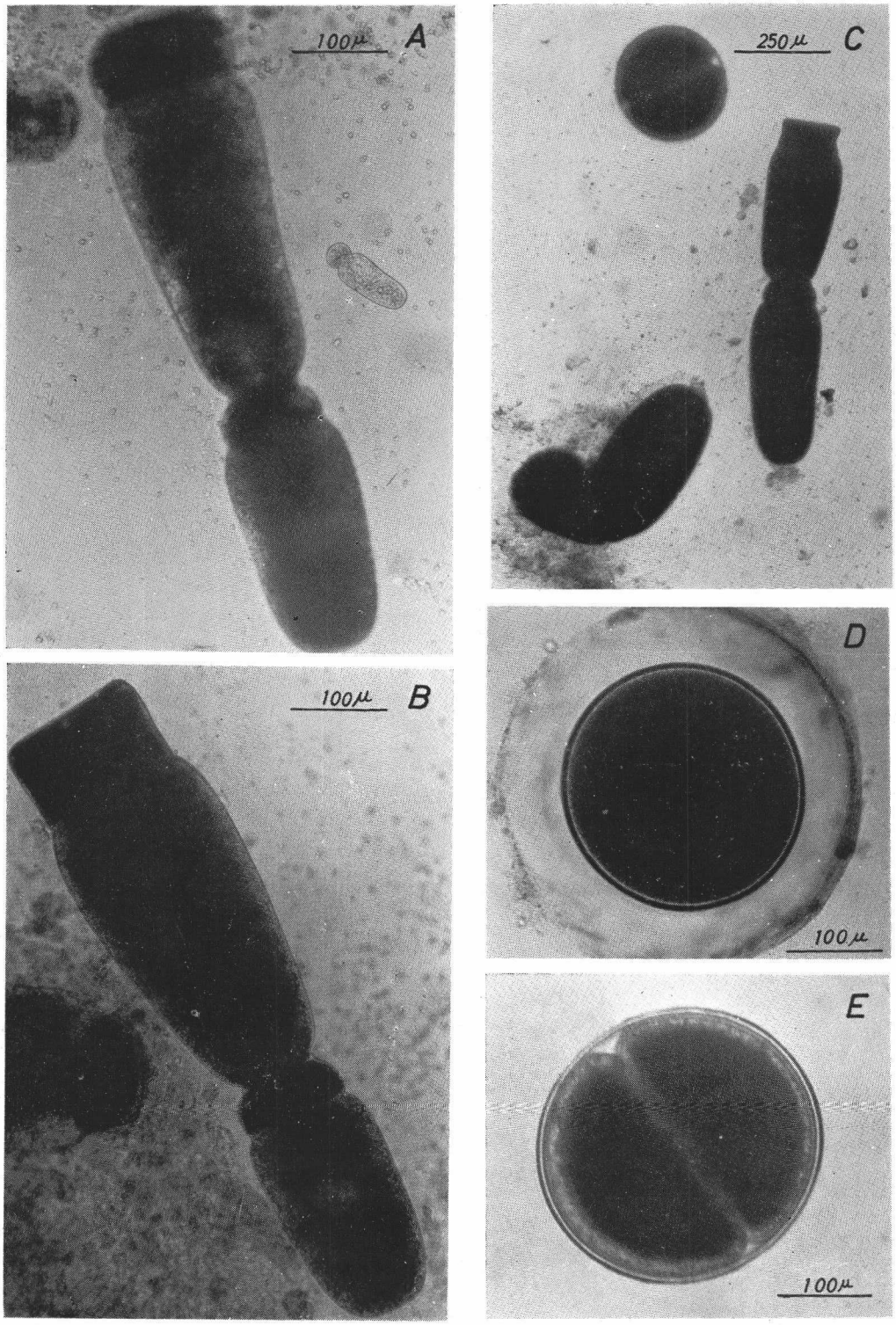

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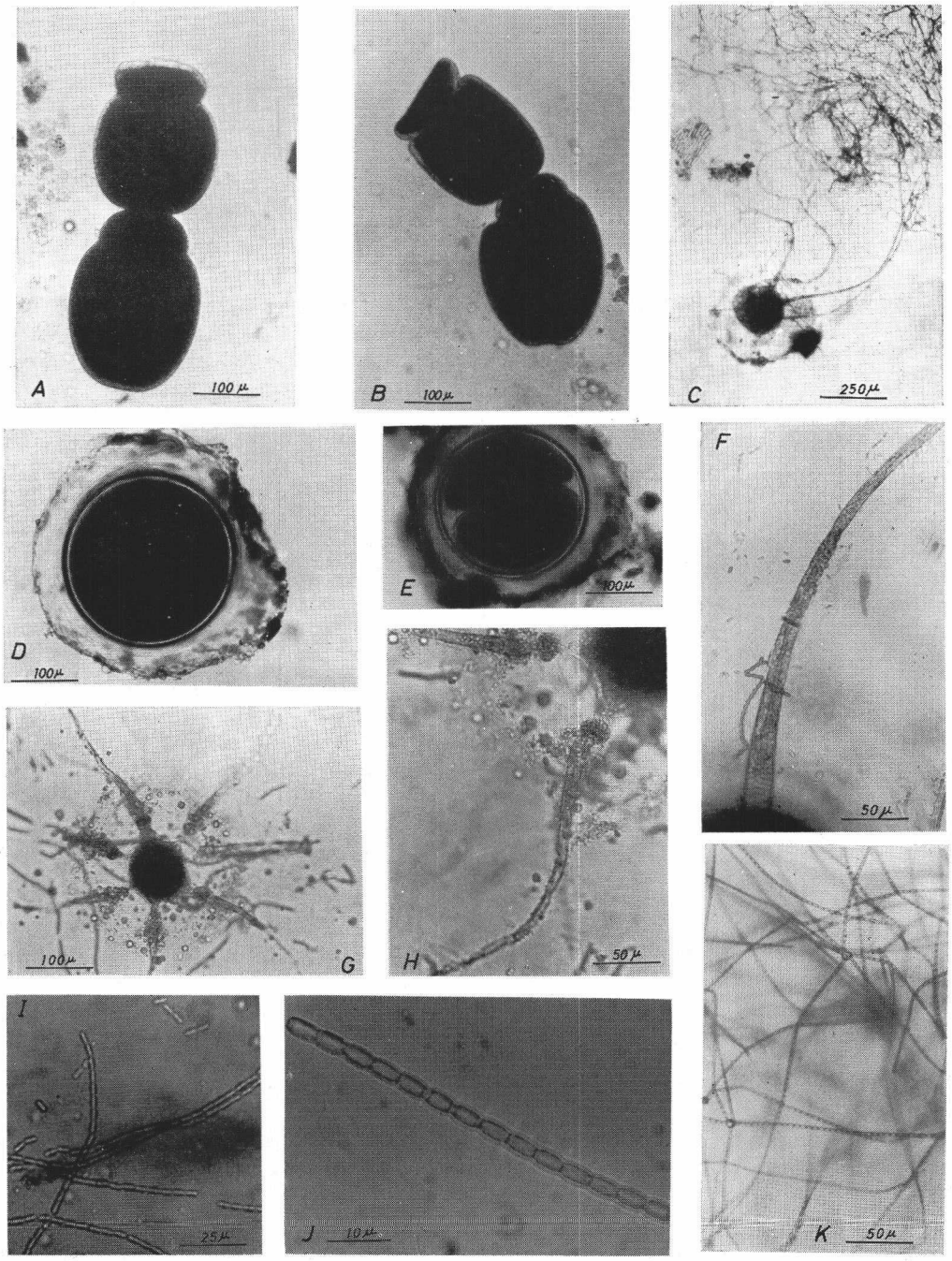
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Fig. 11.