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Notes on the Gregarines in Japan 13.

Two new and one already known species of Eugregarines from Tricoptera larvae.

By

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The taxonomical description on two new and one alreadyknown species of eugregarines from Japanese Tricoptera is written in this paper. Since 1969 the author has been studying the infection of gregarines in aquatic insects. He found several species of eugregarines in several species of aquatic insects : Odonata, Ephemeroptera, Megaloptera and Plecoptera. Among them he wants to report two species of gregarines from Tricoptera larvae and to rewrite the description of gregarine which was repoted by H. Hoshide in 1953. Until now three species of gregarines have been reported from Tricoptera in Japan. One of them *Pileocephalus hydropsychus* from *Hydropsyche* sp. was reported by H. Hoshide in 1953. The other two, *Gemicephalus japonicus* from *Allophylax* sp. and *Pileocephalus dinarthrodes* from *Dinarthrodes japonicus* Tsuda, were reported by K. Hoshide in 1972. In addition to these three species, two new members of gregarines were found in the intestines of Limnophilinae sp. and *Parastenopsyche sauteri* Ulmer. These two gregarines belong to the genus *Pileocephalus* and *Actinocephalus* by the morphology of the epimerite.

Materials and Methods

The host Limnophilinae sp. is a larva of a caddisfly and is caught in a small swiftly flowing mountain stream around Hoshioki Falls. The falls are located at the upper stream of the Otarunai River in Sapporo. The caddisfly is about 15—20mm in body length and makes a portable case which is ususally made of piece of leaves, bits of twigs or sand grains. About 60% of the hosts were parasitized with the gregarines in August 1979. The other host, *Parastenopsyche sauteri* Ulmer, is dark gray and a relatively large caddisfly and is caught in the rill of Aratani and Namera. Aratani is located in the suburbs of Yamaguchi City and Namera is located at the upper stream of the Saba River. The hosts are found in clear, cold and fast-flowing stream. They habituate under pebbles, forming silky net. More than 80% of these hosts collected in August 1974 and 1980 were infected with the

gregarines.

The captured hosts were kept in a refrigerator for two or three days until use. The digestive tructs of the hosts were removed in Ringer's solution and cut open with a fine needle. Many sporadins came out into the Ringer's solution. On the other hand many cephalins with epimerites adhere to the epithelial cells of the host's intestines. The study was done by direct observation or taking photographs.

Pileocephalus hydropsychus H. Hoshide 1953

1953 *Pileocephalus hydropsychus* H. Hoshide 1953 : 8
1957 *Pileocephalus hydropsychus* H. Hoshide 1957 : 35

Host : *Hydropsyche* sp. Larva Hydropsychidae, Tricoptera
Habitat : Intestine
Locality : Hikari, Obatake, Yamato (Yamaguchi Pref.)

I. Sporadin

1 . Association	Solitary.
2 . Measurements	
2—1 . Size	
Average	TL 220 LP 100 LD 120 WP 100 WD 90
2—2 . Ratio	LP : TL=1 : 2.2 WP : WD=1 : 0.9
3 . Shape	Elongate ovoidal.
4 . Protomerite	
4—1 . Shape	Almost ellipsoidal, broadly rounded at apex, widest through middle. Width slightly wider than or equal to that of deutomerite.
5 . Deutomerite	
5—1 . Shape	Ovoidal, contract with age and the length almost as long as that of protomerite, widest a little posterior from septum, thence tapering to a blunt posterior end.
6 . Septum	Conspicuous, constriction fairly deep.
7 . Nucleus	
7—1 . Shape	Spherical, about 20μ in diameter but in living time its contours is almost invisible according to the dense endoplasm.
7—2 . Position	Unfixed.
7—3 . Nucleolus	Many.
8 . Endoplasm	
8—1 . Color	Brown in deutomerite, light brown in protomerite.
8—2 . Granules	Dense and fine in deutomerite but a little coarser and

larger than granules of deutomerite in protomerite.

9. Ectoplasm — Well developed.

II. Cyst

1. Structure — Spherical, average 170μ in diameter.

2. Dehiscence — By simple rupture.

III. Spore

1. Shape — Biconical, obese.

2. Size — $7 \times 4\,\mu$

IV. Movement — Not active.

V. Cephalin

1. Shape — Cephalins (90—100μ in length) body elongte ovoidal, protomerite almost subglobular being nearly equal in length to its width, deutomerite ovoidal to elongate ovoidal, length twice the width, widest at a short distance posterior from septum, thence tapering to a blunt posterior end. More grown cephalins (200μ or so in length) body elongate cylindrical, protomerite ovoidal, widest at just above the septum, or near its middle, well rounded at apex and rather flat at base, constriction at septum distinct, deutomerite elongate cylindrical widest a little posterior from shoulder, thence tapering gradually to a posterior end.

2. Structure — In young cephalin almost transparent lacking the endoplasm but they become brown to dark brown in color increasing the endoplasm with age.
Granules in protomerite larger and coarser than those in deutomerite.

3. Epimerite — Epimerite spherical with short neck in young cephalin but the corona transform into a lanceolate head with a long cylindrical stalk, whole length of epimerite almost equal to the length of protomerite.

Pileocephalus sapporoensis n. sp.

Host : Limnophilinae sp.
Habitat : Intestine
Locality : Sapporo (Hokkaido)

I. Sporadin

1. Association — Solitary.

2. Measurements

2—1. Size	
Maximum	TL 605 LP 165 LD 440 WP 225 WD 249
Average	TL 480 LP 125 LD 355 WP 200 WD 230
2—2. Ratio	LP : TL= 1 : 3.8 WP : WD= 1 : 1.2
3. Shape	Well grown sporadins obese, ovoidal but younger ones elongate ovoidal.
4. Protomerite	
4—4. Shape	Almost hemispherical, a little wider than long, widest through middle, broadly rounded or sometimes near conical at apex.
5. Deutomerite	
5—1. Shape	Ovoidal, widest at shoulder, thence tapers to an obtuse posterior extremity, a small conical projection at the posterior end often observed.
6. Septum	Septum constriction here fairly deep.
7. Nucleus	
7—1. Shape	Spherical to somewhat ellipsoidal, 55×45μ.
7—2. Position	Generally at the anterior region of deutomerite but not fixed.
7—3. Nucleolus	Spherical, large one accompanied by several small ones.
8. Endoplasm	
8—1. Color	Brown.
8—2. Granules	Dense and fine in both protomerite and deutomerite.
9. Ectoplasm	Stout, fairly thick.
II. Cyst	
1. Structure	Spherical, average 300μ in diameter, covered with two cyst membranes, inner one is thin transparent, outer one thick, 40—45μ in thickness, gelatinous.
III. Spore	Not observed.
IV. Movement	Gliding and bending not active.
V. Cephalin	
1. Shape	A young cephalin (except the epimerite 40μ in length) ellipsoidal in shape, differentiates three body segments : epimerite, protomerite and deutomerite, the epimerite is rather longer than the body length. The body lengthens with age and the shape of body changes to elongate ellipsoidal in an older cephalin (80μ in length), the septum and constriction become conspicuous, the epimerite (30μ in length) attaches to the top of protomerite with short stalk.

2. Structure — In the young cephalin, body almost transparent, endoplasm is scanty.
The endoplasm increases gradually with age, body becomes darker in color.

3. Epimerite — Lance-shaped with a short neck, the neck lengthens a little with body growth but not much.
Sometimes a well grown cephalin (300μ or so in length) observed having an epimerite of 50μ in length at the anterior end of protomerite.

Table 1. *Pileocephalus sapporoensis* n.sp.

Measurements and Ratio of Sporadins (unit μ)

TL	605	520	510	450	435	445
LP	165	125	145	110	120	100
LD	440	395	365	340	315	345
WP	225	195	230	210	175	195
WD	249	225	250	290	175	220
Ratio						
LP : TL	1 : 3.7	1 : 4.2	1 : 3.5	1 : 4.1	1 : 3.6	1 : 4.6
WP : WD	1 : 1.1	1 : 1.2	1 : 1.1	1 : 1.4	1 : 1.0	1 : 1.1

Remarks:

Though the spore of this gregarine has not been observed, it belongs to the genus *Pileocephalus* because epimerite is lance-shaped with a short neck.

This species bears a resemblance in the shape of cephalins to *P. heerii* (Kölliker 1845) Schneider differing from it as follows: the ratio is LP : TL = 1 : 3.8, WP : WD = 1 : 1.2 in *P. sapporoensis* but that is LP : TL = 1 : 3, WP : WD = 1 : 1.0 in *P. heerii*. The protomerite of *P. sapporoensis* is almost hemispherical, widest through middle, that of *P. heerii* is conical, widest just above septum. The nucleus of *P. sapporoensis* is generally spherical, that of *P. heerii* is ellipsoidal.

Actinocephalus laticaudatus n. sp.

Host : *Parastenopsyche sauteri* Ulmer — Larva and pupa Stenopsychidae, Tricoptera

Habitat : Intestine

Locality : Yamaguchi (Yamaguchi Pref.)

I. Sporadin

1. Association — Solitary.

2. Measurements

2—1. Size	
Average	TL 514 LP 74 LD 440 WP 185 WD 220
2—2. Ratio	LP : TL= 1 : 6.9WP : WD= 1 : 1.2
3. Shape	Tadpole-shaped with broad depressed tail-like projection at posterior side.
4. Protomerite	
4—1. Shape	Hemispherical, broadly rounded or rather flattened at apex, widest at base, width about three times or more as wide as heigh.
5. Deutomerite	
5—1. Shape	Divided into two parts : anterior and posterior region. The former swollen, almost globular, widest through its middle, the latter projected from the end of the former like tail, broad and sometimes elongate conical, depressed, widest at anterior portion, thence tapering gradually to a blunt or a pointed posterior extremity.
6. Septum	Distinct, shallow constriction here.
7. Nucleus	
7—1. Shape	Generally spherical, sometimes ellipsoidal, 40μ in diameter.
7—2. Position	Anterior globular region of deutomerite but the position in it not fixed.
7—3. Nucleolus	One, spherical rather large.
8. Endoplasm	
8—1. Color	Protomerite and tail region of deutomerite light brown, globular main region of deutomerite dark brown.
8—2. Granules	Homogeneous, fine in protomerite, very dense in the globular region of deutomerite but in the tail region granules often scatter unevenly, mottled.
9. Ectoplasm	Fairly thick.
II. Cyst	
1. Structure	Spherical.
III. Spore	Not known.
IV. Movement	Gliding observed but not so active.
V. Cephalin	
1. Shape	In early stage ovoidal, lengthen with age becoming elongate ovoidal.
2. Structure	Protomerite conical, deutomerite ovoidal, both almost devoid of endoplasm, transparent.
3. Epimerite	A corona with several recurved processes, each slightly

dilated at the distal extremity, with short or long neck.

Table 2. *Actinocephalus laticaudatus* n. sp.

Measurements and Ratio of Sporadins (unit μ)

TL	624	603	593	530	478	437
LP	83	104	73	62	83	73
LD	541	599	520	468	395	364
WP	239	218	239	166	177	177
WD	260	302	270	177	229	218
Ratio						
LP : TL	1 : 7.5	1 : 5.8	1 : 8.1	1 : 8.5	1 : 5.8	1 : 6.0
WP : WD	1 : 1.1	1 : 1.4	1 : 1.1	1 : 1.1	1 : 1.3	1 : 1.2

Remarks :

This species belongs to genus *Actinocephalus* by its shape of the epimerite. Due to a curious form of sporadin described above, the writer cannot identify it with any other species of the genus *Actinocephalus*, and considers it to be a new species. He proposes the name *Actinocephalus laticaudatus* n. sp. for it.

References

1. Baudoin, J. 1967. Contribution a l'etude morphologique, biologique et ecologique des Gregarines d'Insectes a larves aquatiques. Ann. Station Biol. Besse-en-Chandesse. : 1—153.

2. Hoshide, H. 1953. Studies on Gregarines Parasitic in Japanese Insects VII. Zool. Mag. Tokyo. 62(5) : 170—174.

3. ———1958. Studies on the Cephaline Gregarines II. 3) Description of the members belonging to the Families Didymophydae, Actinocephalidae. Acanthosporidae, Stylocephalidae, Dactylophoridae. Bull. Fac. Educ. Yamaguchi Univ. VIII : 35—101.

4. Hoshide, K. 1971. Studies on Gregarines from Japan. II, *Cephaloidophora anisogammari* n. sp. and *Cephaloidophora elongata* n. sp. from Amphipoda. Jour. Fac. Sci. Hokkaido Univ. Ser. IV. Zool. 18(1) : 186—192 pl. 1.

5. ———1972. Notes on Gregarines in Japan 4. Two Eugregarines from Tricoptera larvae. Bull. Fac. Sci. Educ. Yamaguchi Univ. Vol. 22 : 23—34. Pl. 2.

6. Schneider, A. 1875. Contribution a l'histoire des Gregarines des Invertebres de Paris et de Roscoff, Arc. Zool. exp. gen. 4 : 493—604.

7. Tsuda, M. 1962. Aquatic Entmology : 1—269.

8. Watson, M. E. 1916. Studies on Gregarines. Illinois biol. monog. 2 : 1—258.

Explanation of Figures

Fig. 1.

A. B. *Pileocephalus hydropsychus* H. Hoshide. After H. Hoshide 1953 Fig. 1. a, e.

C. D. E. G. H. I. *Pileocephalus sapporoensis* n. sp.

C. Well matured sporadin, a small conical projection shown at the posterior end of deutomerite.

D. E. F. Young sporadins.

G. H. Cephalins with lance-shaped epimerite at apex of protomerite.

I. Cyst.

Fig. 2.

Actinocephalus laticaudatus n. sp.

A. Well matured sporadin.

B. One of sporadin bending its body.

C. Elongate sporadin.

D. Small sporadin.

E. Cephalin with epimerite.

F. Enlarged epimerite.

G. Nucleus with spherical nucleolus.

Fig. 3.

Pilcocephalus sapporoensis n. sp.

A. Host, Limnophilinae sp.

B. Sporadin and cephalin coexist.

C. D. Matured sporadin.

E. Young sporadin.

F. Two matured sporadins.

G. Enlarged nucleus.

Fig. 4.

Pileocephalus sapporoensis n. sp.

A. B. C. D. Cephalin with epimerite.

E. F. Cyst.

Fig. 5.

Actinocephalus laticaudatus n. sp.

A. Host, *Parastenopsyche sauteri* Ulmer.

B.C.D.E. Sporadin.

F. Cephalin without epimerite.

Fig. 1.

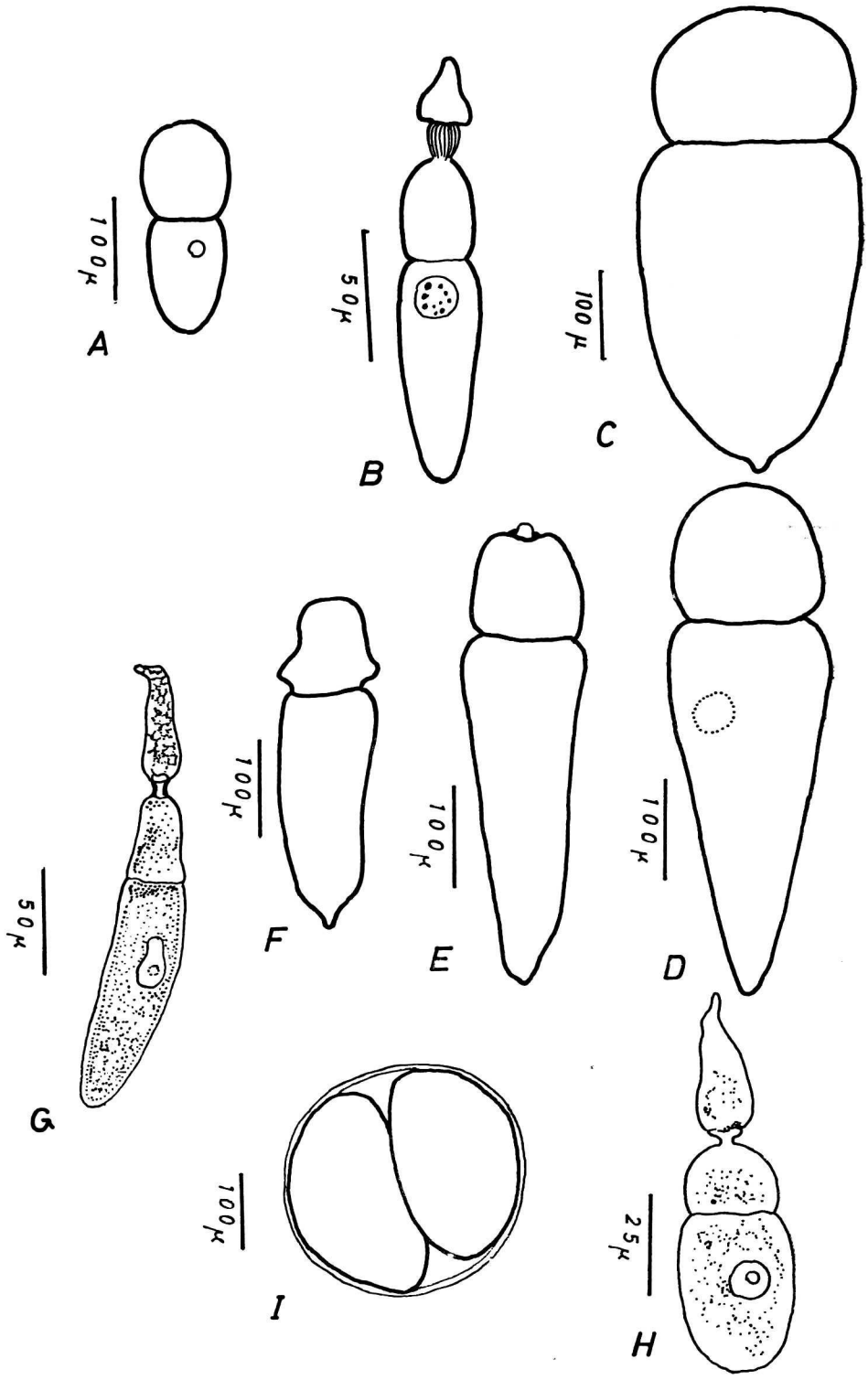

Fig. 2.

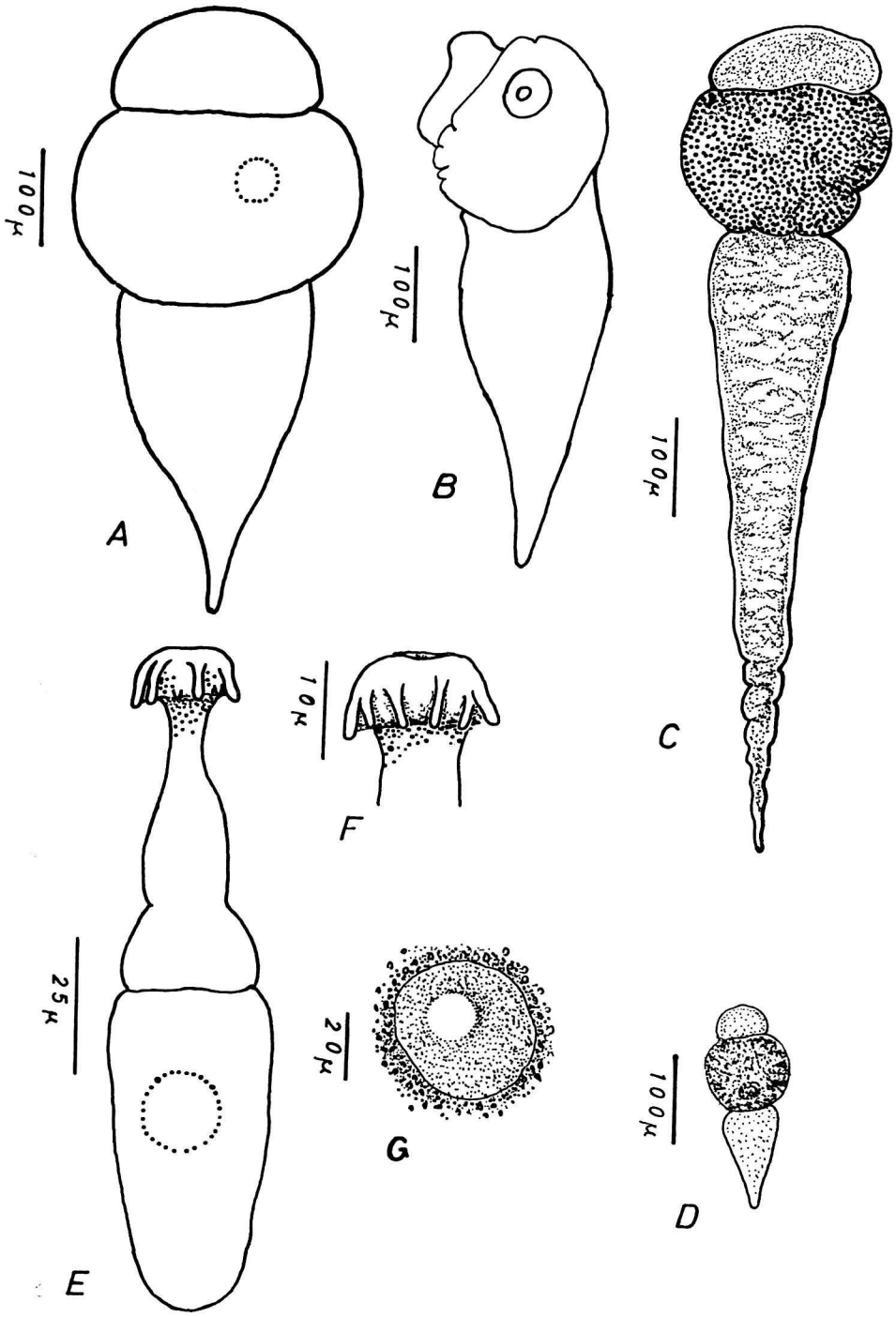

Fig. 3.

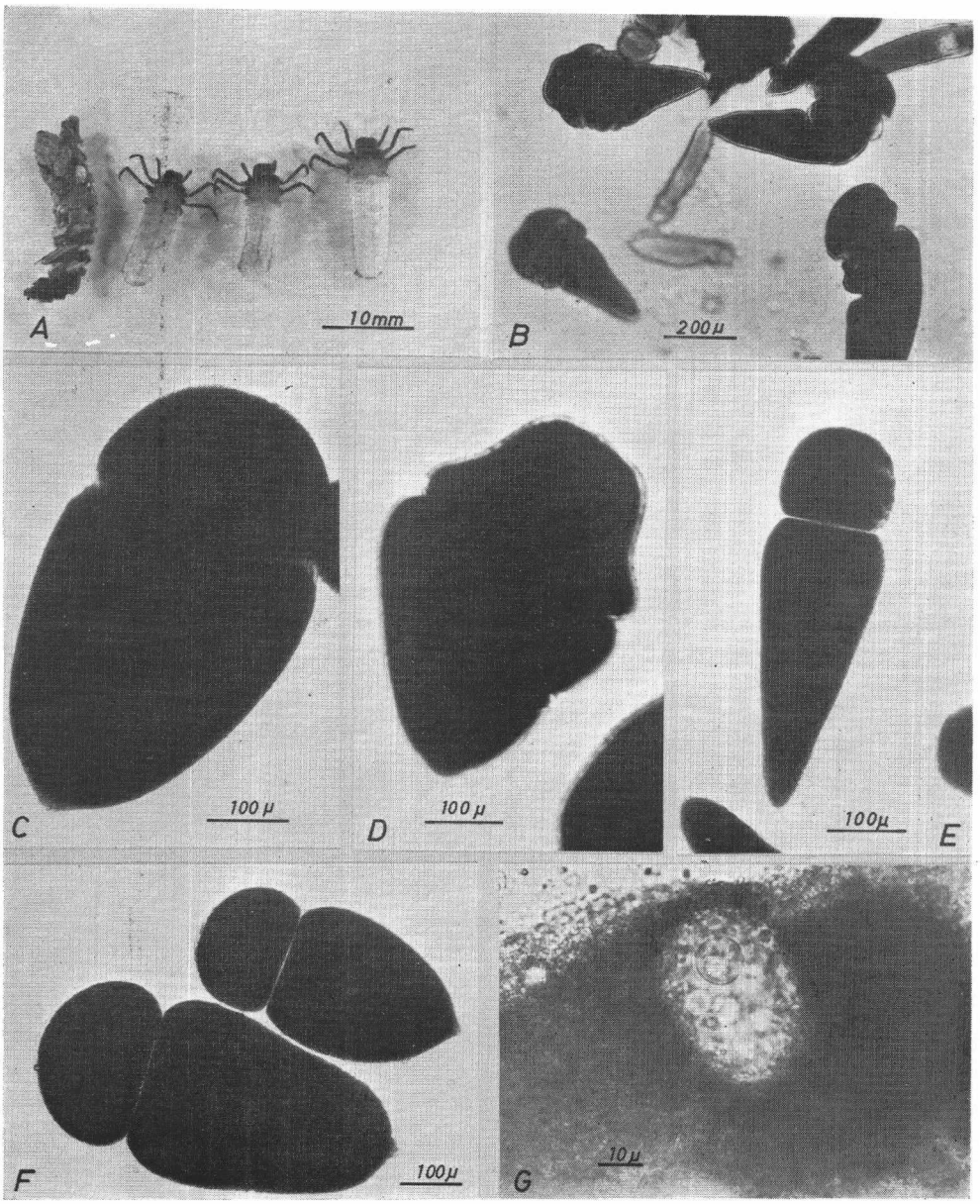

Fig. 4.

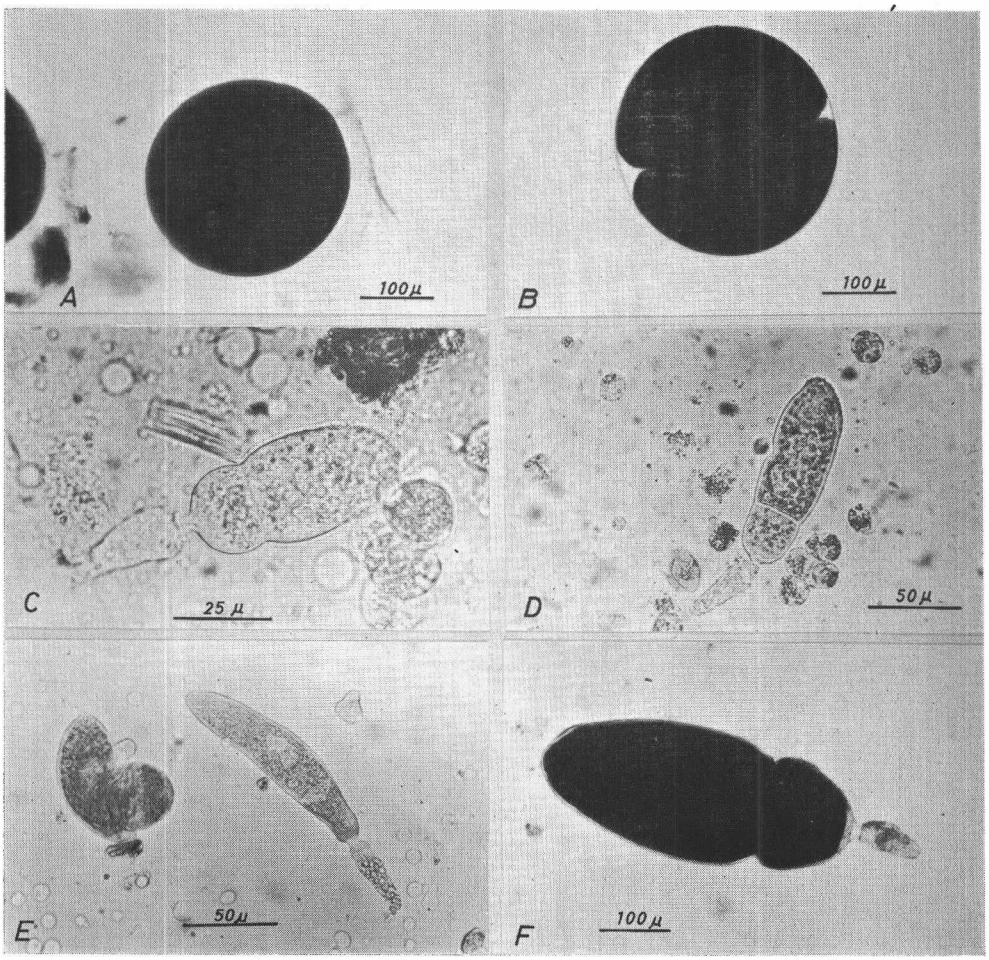

Fig. 5.