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Notes on Gregarines in Japan 4.

Two Eugregarines from Tricoptera larvae

By

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The author has been studied upon the gregarines fauna in Japan since 1967 and recorded some gregarines from terrestorial and aquatic insects (1968, 1969).

He wants to report the morphorogical and taxonomical descriptions of two new Eugregarines from Tricoptera larvae in this paper. Many species of Tricoptera larvae were reported by Iwata or Tsuda (1962) in Japan, but only one gregarine which is parasite of Tricoptera larva was reported by Hyoma Hoshide (1953). He reported that this species belongs to *Pileccephalus*, but according to the Baudoin's conception (1967) it should be attached to the other genus *Asterophora*.

Recently the author observed three Tricoptera larvae around Yamaguchi City and found two new gregarines from them. The existence of *Gemmicephalus japonicus* n. sp. was already related by Hyoma Hoshide, but there is no description yet. At that time H. Hoshide thought this species belonged to the genus *Pileocephalus* but the author thinks it should be attached to the genus *Gemmicephalus*.

This observation was done from March to June in 1972.

Materials and Methods

Three Tricoptera larvae—*Allophylax* sp., *Dinarthrodes japonica* Tsuda and *Neos everinia crassicornis* Ulmer—were examined for the existence of gregarines. Two of them, *Allophylax* sp. and *Dinarthrodes japonica* Tsuda, were parasitized by gregarines.

Many *Allophylax* sp. larvae were captured from early spring to early summer in the small streams which flow in the maneuver field of Self-Defence-Army at Miyano in Yamaguchi City. *Dinarthrodes japonica* larvae inhabits some tributaries of Fus hino river. Hosts used in this study are captured at Miyano (Era) or Niho. Many *Dinarthrodes* larvae are generally captured on dead branches or leaves which lay down among stones in the rapid streams. During this time most larvae are parasi tized by gregarines. 54 of 62 *Dinarthrodes* larvae inspected on June 2nd in 1972 were parasitized by gregarines. After summer the number of the host conspicuously decreases by emergence and the ratio of parasite decreases, too. 3 of 10 *Dinarthrodes* larvae inspected in the autumn of 1971 were parasitized by gregarines. From March to June most gregarines are attached to the wall of host's intestine. If the

intestine is cut open by niddles in the Ringer's solution, many cephlonts of different stages are released into the solution.

The study was done by direct observation or taking photographs. The observation was done by living specimens or fixed ones. The fixed specimen with dilute Lugol's solution gives the best result.

1. *Gemmicephalus japonicus* n. sp.

(Fig. 1.—1~7, Pl. I. —1~8)

Host : *Allophylax* sp.
Habitate : Intestine
Locality : Miyano (Sakurabata), Yamaguchi City
Time : March—June 1972
Ratio of infection : 100%

Diagnosis

I. Sporadin

1.	Association	Solitary
2.	Measurements	
2—1.	Size (unit μ)	
	Maximum	TL 450, LP 70, LD 380, WP 55, WD 72
	Average	TL 398, LP 58, LD 339, WP 63, WD 88
	Nucleus	40
2—2.	Ratio	LP : TL=1 : 6.8, WP : WD=1 : 1.4
4.	Protomerite	
4—1.	Shape	Almost spherical Anterior part of protomerite protrude as dome like shape. At middle part of protomerite widest, at just front of widest part very shallow constriction.
5.	Deutomerite	
5—1.	Shape	Cylindrical Width of deutomerite suddenly increase at just after septum, posterior part of shoulder gradually increase width. End of deutomerite broadly rounded. But in living time various forms are observed. Some shape oblanceolate and others have a little concave at middle of deutomerite.
6.	Septum	Conspicuous, deep constriction
7.	Nucleus	
7—1.	Shape	Spherical

	In living time margine of nucleus often not clear by it's thick endoplasm.
7—2. Position	Unfixed
7—3. Nucleolus	1—6
8. Endoplasm	
8—1. Color	Light brown Color of endoplasm lighter than that of deutomerite.
8—2. Granules	Large granules are observed in both protomerite and deutomerite. At part around top of protomerite lack granules. In deutomerite granules homogeneous. Granules in protomerite less than in deutomerite.
9. Ectoplasm	Thick and comparatively tough. Thickness 2·5—3μ. Thicker at top of protomerite than at other parts. In living time fine longitudinal striations are observed on surface of epicyte.
II. Cyst	
1. Structure	Spherical, diameter 150—190μ. Just after formation thin transparent membrane covered cyst. Afterwards semitransparent gelatinous membrane covered surface of cyst. Thickness of former membrane is about 5—6μ and that of latter about 60—70μ. It being kept in moist chamber, spores are formed in it.
2. Dehiscence	Dehiscence of spore by simple rapture
III. Spore	
1. Shape	Swollen biconical
2. Size	6 x 4μ
IV. Movement	Gliding movement Anterior half of protomerite often show bending movement.
V. Cephalin	
1. Shape	Young stage ovoidal It lengthen and become elongate ovoid with age.
2. Structure	Smallest cephaline observed 20μ. It already differentiated into three segments, epimerite, protomerite and deutomerite. Anterior half of protomerite bend frequently.
3. Epimerite	Attach to protomerite with very short stalk. According to develoment of body it change size and

Table 1. *Gemmicepalus japonicus* n. sp.
Measurements and Ratio of sporadins (unit μ)

Full grown stage					
Measurements					
TL	420	410	408	382	368
LP	65	60	58	55	54
LD	355	350	350	327	314
WP	80	72	63	52	50
WD	110	98	90	72	68
Ratio					
LP : TL	1 : 6.5	1 : 6.8	1 : 7.3	1 : 6.8	1 : 6.8
WP : WD	1 : 1.4	1 : 1.4	1 : 1.4	1 : 1.4	1 : 1.4
Previous stage					
Measurements					
TL	450	400	300	210	150
LP	70	65	50	40	30
LD	380	335	255	170	120
WP	48	48	40	40	30
WD	52	50	46	42	32
Ratio					
LP : TL	1 : 6.4	1 : 6.2	1 : 6.0	1 : 5.2	1 : 5.0
WP : WD	1 : 1.1	1 : 1.0	1 : 1.2	1 : 1.1	1 : 1.1

shape. At early stage, spherical, 7 x 7μ and later it become bud like oval, 9 x 5μ.

Remarks :

The new genus *Gemmicephalus* was created for the gregarines from the larva of *Athripsodes cinereus* (Tricoptera) by Baudoin (1967). The characters of genus *Gemmicephalus* are following.

1. Epimerite "bourgeon ovalaire" bud like oval
2. Spore "legergement biconiques" slightly biconical

This species, *Gemmicephalus japonicus* n. sp., has some similarity to *Gemmicep halus mutabilis* BAUDOIN, but the former species is different from the latter species in the folloing points shown in Table 2.

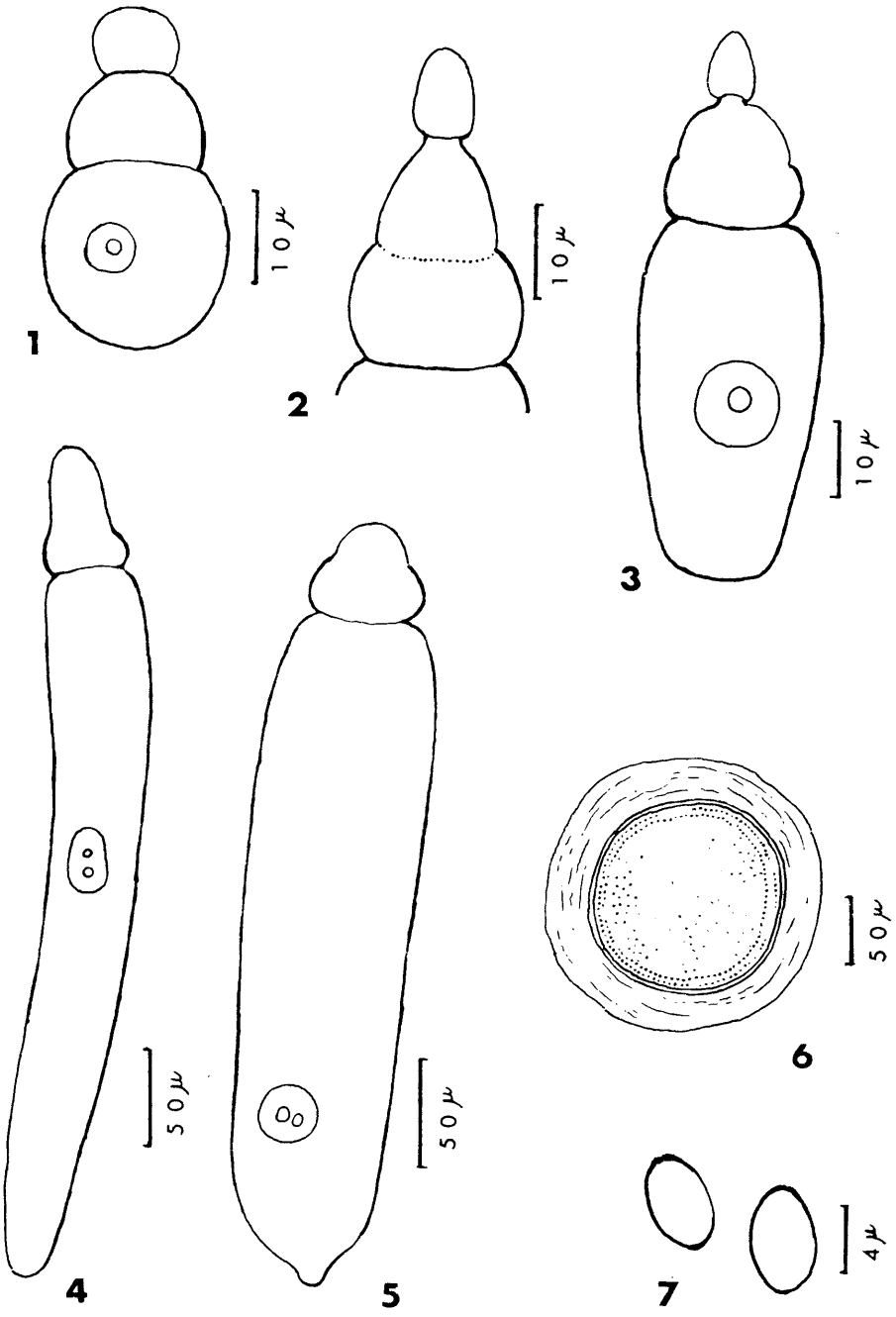

Fig. 1. *Gemmicephalus japonicus* n. sp. 1. Small cephalin. 2. Anterior portion of cephalin. 3. Slightly grown cephalin. 4. Previous stage of sporadin. 5. Full-grown sporadin. 6. Cyst. 7. Spores.

Table 2.

Species / Diagnosisnumber	*Gemmicephalus japonicus* n. sp.	*Gemmicephalus mutabilis* Baudoin
I. Sporadin		
2—1. Size	TL 398μ	TL 300μ
2—2. Ratio	LP : TL=1 : 6.8	LP : TL=1 : 4—5
7. Nucleus	Sphrical	Spherical
II. Cyst	150 — 190μ	190μ
III. Spore	swollen biconical without mucron 6 × 4μ	slightly biconical without mucron 8 × 5.5μ
V. Cephalin		
3. Epimerite	bud like oval (at early stage spherical) 10 × 5μ	bud like oval 14 × 10μ

2. *Pileocephalus dinarthrodes* n. sp.
(Fig. 2.—1～10, Pl. II.—1～8.)

Host : *Dinarthrodes japonica* Tsuda larva
Habitate : Intestine
Locality : Tributaries of Fushino river
Ratio of parasite : 87%

Diagnosis

I. Sporadin
1. Association — Solitary
2. Measurements
2—1. Size (unit μ)
Maximum — TL 85, LP 21, LD 64, WP 35, WD 55
Average — TL 74, LP 17, LD 57, WP 31, WD 49
Nucleus — 13
2—2. Ratio — LP : TL=1 : 4.4, WP : WD=1 : 1.6
4. Protomerite
4—1. Shape — Hemispherical
Width longer than length. Widest at middle part of protomerite.
4—2. Structure — Posterior part of protomerite thrust into anterior part of deutomerite.
5. Deutomerite

5—1.	Shape	Ovoidal Widen from shoulder part to middle of deutomerite. Widest at a little front of middle part. Taper from widest part to posterior end. Posterior end blunt rounded.
6.	Septum	Distinct, deep constriction
7.	Nucleus	
7—1.	Shape	Spherical, 15—16 μ in diameter
7—2.	Position	Usually situated at middle of deutomerite, but not definitely fixed.
7—3.	Nuoleolus	5—6
8.	Endoplasm	
8—1.	Color	Brown
8—2.	Granules	Comparatively large and coarse in protomerite and dense and fine in deutomerite.

V. Cephalin

From March to June most individuals attach to the wall of host's intestine.

1.	Shape	Young stage glovular Grown cephalin ovoidal, slender than matured sporadine.
2.	Structure	Smallest cephalin observed 25 μ Body spherical, and its segment hasn't completely differenciated yet. Comparatively large conical epimerite at top of body. Slightly grown cephalin (35—40 μ in length), ovoidal, three segments are faintly shown. Large grown cephalin (more 50μ in length) body segments distinctly differentiate. These variations are given in Table 3. and Figure 2.
3.	Epimerite	With growth, epimerite change individualy in shape. Many different forms are observed in grown epimeri tes with no stalk. a) lance-shaped, 20 x 23μ (Fig. 2.—7) b) blunt lance-shaped, 20 x 20μ (Fig. 2.—8) c) bowl like shape, 20 x 12~15μ (Fig. 2.—9, 10)

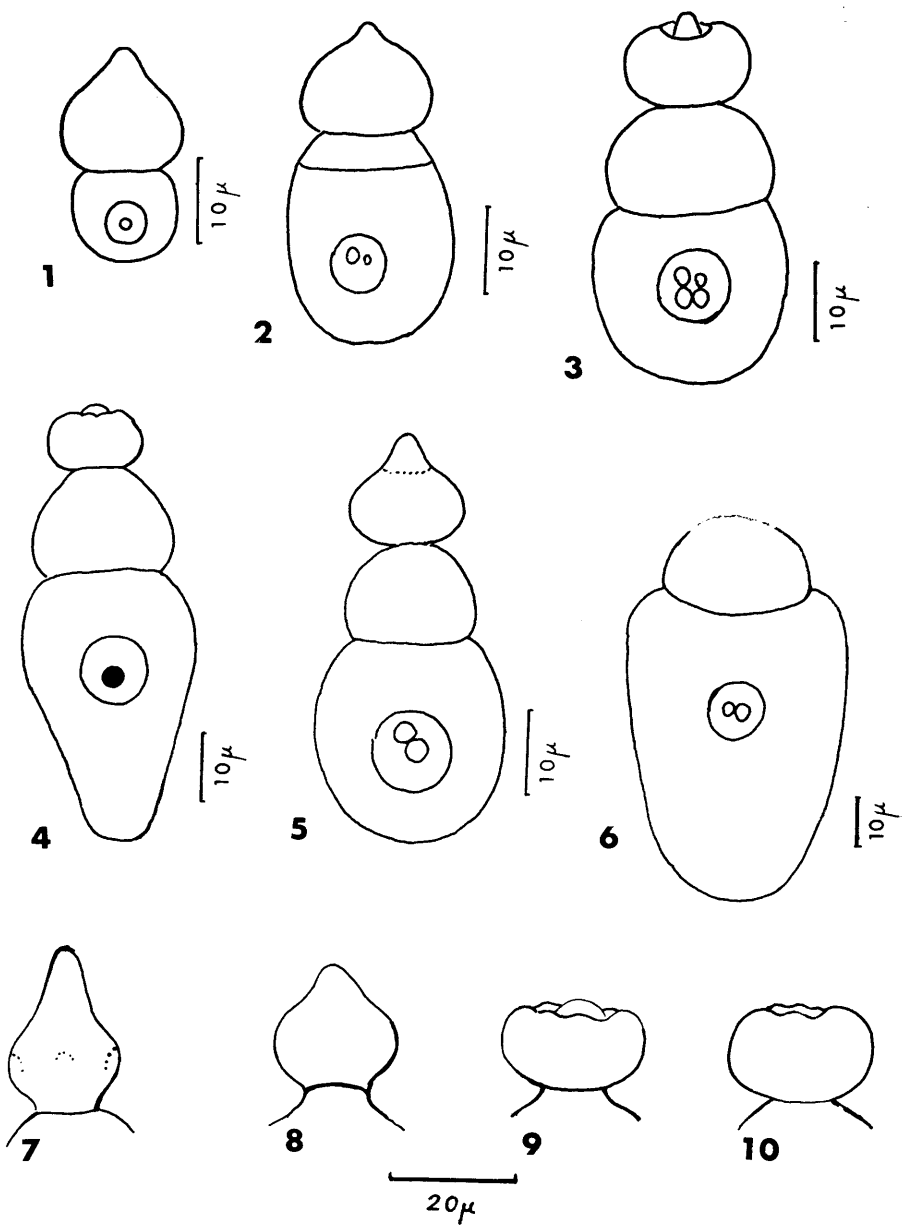

Fig. 2. *Pileocephalus dinarthrodes* n. sp. 1. Small cephalin with imparfect segments. 2, 3, 5. Slightly grown cephalin. 4. Grown cephalin. 6. Sporadin. 7, 8, 9, 10. Various types of epimerite.

Table 3. Pileocephalus dinarthrodes n. sp.
Measurement and Ratio (unit μ)

Sporadins					
Measurements					
TL	85	85	80	69	65
LP	18	20	17	15	14
LD	67	65	63	54	51
WP	30	35	30	31	30
WD	52	50	45	48	47
Ratio					
LP : TL	1 : 4.7	1 : 4.3	1 : 4.7	1 : 4.6	1 : 4.6
WP : WD	1 : 1.7	1 : 1.4	1 : 1.5	1 : 1.5	1 : 1.6
Large cephalins					
Measurements					
TL	75	68	63	50	50
LP	20	18	19	15	13
LD	55	50	44	35	37
WP	33	33	25	25	23
WD	43	38	37	33	30
LE	12	20	20	12	12
Ratio					
LP : TL	1 : 3.8	1 : 3.8	1 : 3.3	1 : 3.3	1 : 3.8
WP : WD	1 : 1.3	1 : 1.2	1 : 1.5	1 : 1.3	1 : 1.3

Remarks :

Genus *Pilocephalus* was created by Schneider in 1875. According to the monograph written by Kamm (1922) the characters of the genus *Pilocephalus* are as follows.

1. Epimerite a small lance-shaped or simple conoidal papilla placed unstalked upon the protomerite.
2. Spore biconical

Afterwards some gregarines from Tricoptera (Labbé, 1899., Schneider, 1887., Théodoridès et Ormières, 1958., H. Hoshide, 1953., Baudoin, 1967), Coleoptera (Labbè, 1899., Frenzel, 1892., H. Hoshide, 1952), Orthoptera (Frenzel, 1892) and Plecoptera (Foerster, 1938) had been attached to the genus *Pileocephalus*. In 1967 Baudoin J. rearranged this genus. He remained only four species, *P. sinensis* Schneider 1875, *P. glyphotaelii* Stein 1960, *P. lanceatus* Baudoin 1967, *P. scyphoides* Baudoin 1967, in this genus *Pileocephalus*. And he moved the rest of them to the other genus. He lists up the characters of *Pileocephalus* as follows.

1. Parasite from Tricoptera

2. Different points from the genus *Asterophora*
   a) The development of crown body of epimerite is poor.
   b) Spore is bulging.

Though the cyst and spores haven't been observed, this gregarine may be clsssified to the genus *Pileocephalus* by the shape of the epimerite and host. Among of the members of this genus this species resembles *P. glyphotaelii* Stein 1960 which is consulted the Baudoin's description (1967) by the author. But these two are different in the following points.

1. In the size of sporadin the former is less than the latter.
2. The ratio of body LP : TL=1 : 3.8 in the former but 1 : 3 in the latter.

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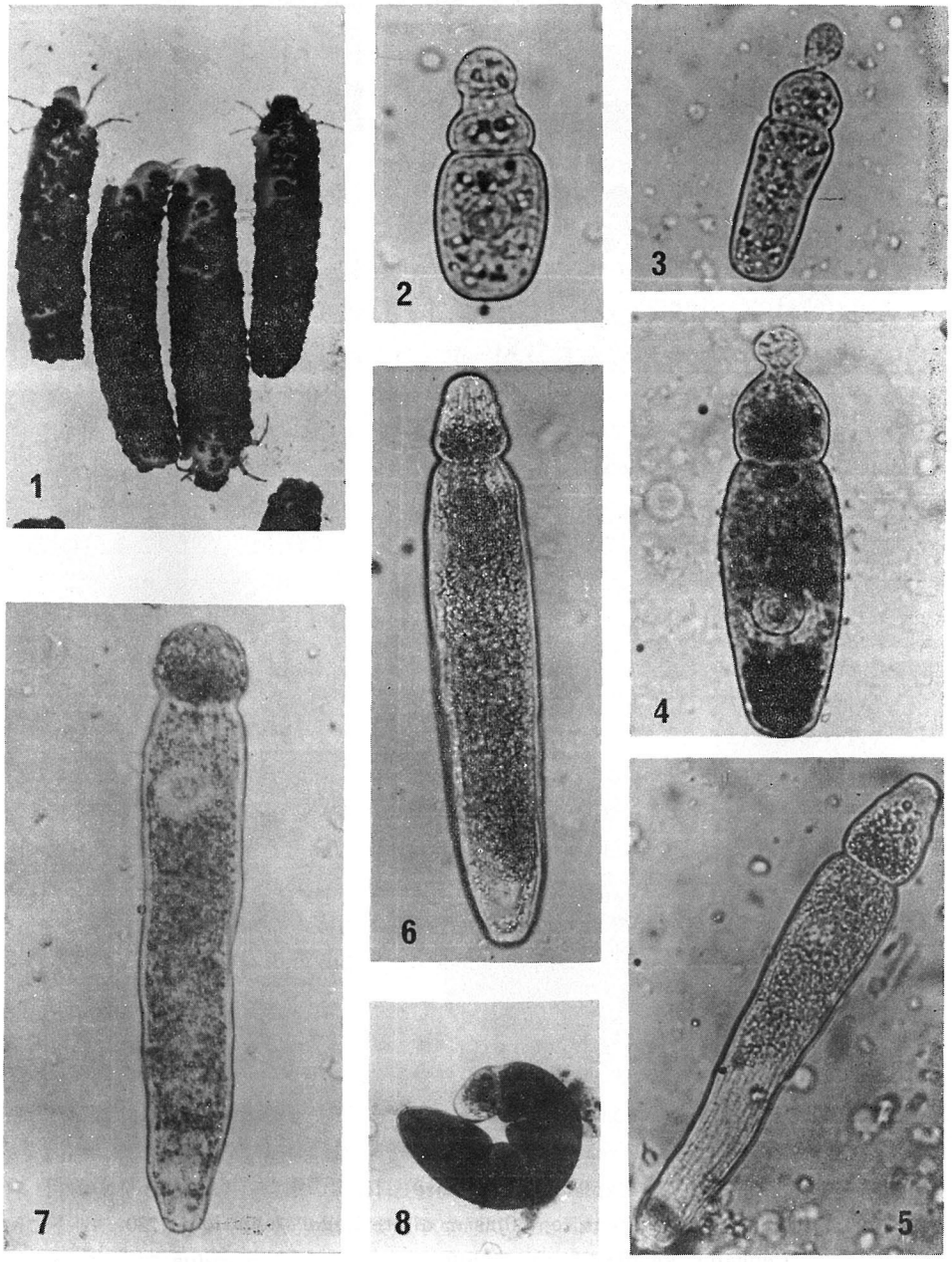
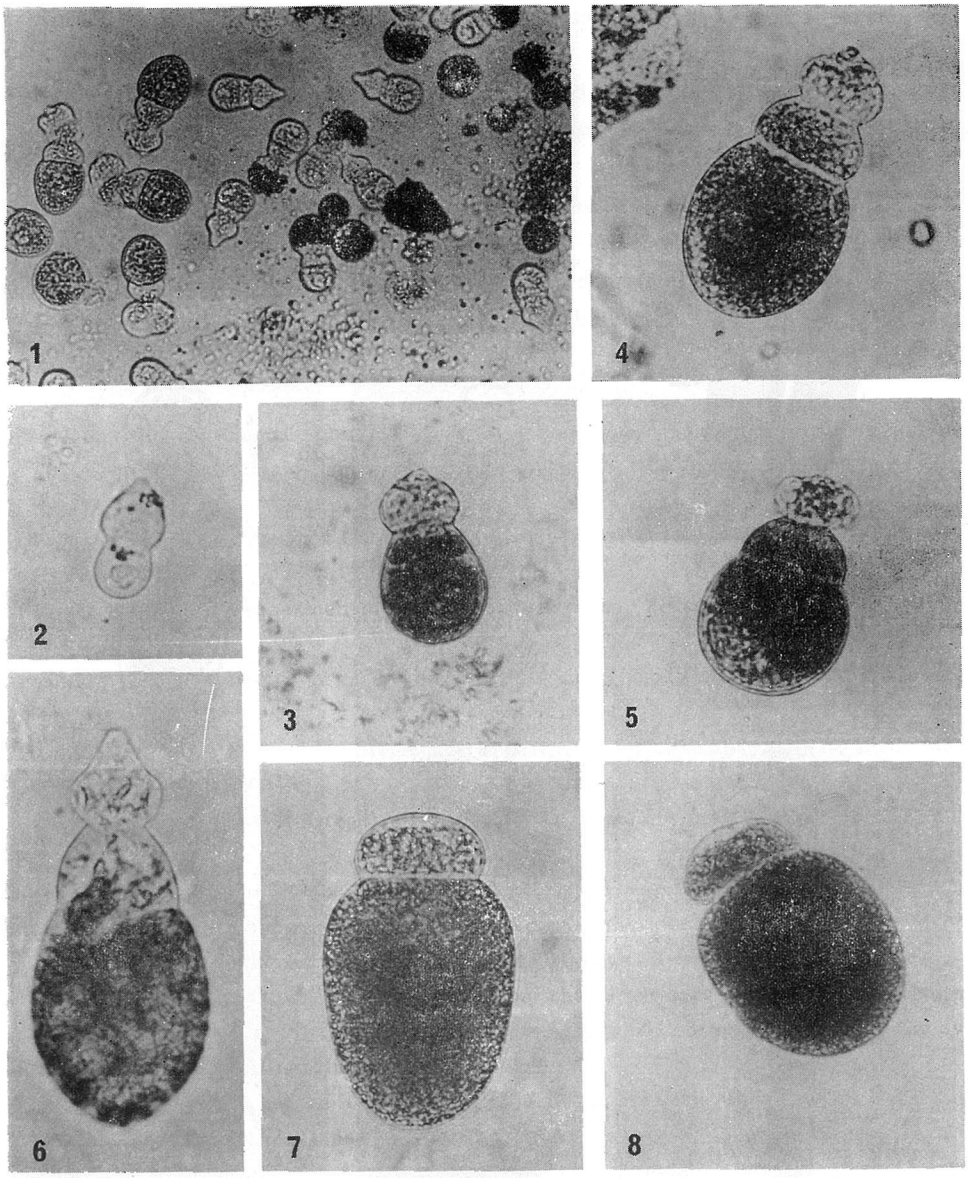
Plate Gemmicephalus n. sp.



Explanation of Plate I.

1. Host of G. japonicus, Allophylax sp. ×2.5
2. Small cephalin ×890
3. Another small cephalin ×560
4. Slightly grown cephalin ×560
5. Previous stage of sporadin ×350
6. Previous stage of another sporadin ×240
7. Rather grown sporadin ×240
8. Well grown sporadin bending its body ×120

Plate II. Pileocephalus dinarthrodes n. sp.



Explanation of Plate II.

1. Released numerous cephalins in dilute Lugol's solution ×280
2. Cephalin (smallest one) ×610
3. ×280
4. Cephalin (slightly grown ones) ×550
5. ×280
6. Grown cephalin ×520
7. ×520
8. Sporadin ×520