STUDIES ON THE CEPHALINE GREGARINES OF JAPAN. (II).

1) Description of those belonging to the Families Lecudinidae, Polyrhabdinidae Cephaloidophoridae and Stenophoridae.

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I have hitherto given out fragmentary reports of my studies on Cephaline, Acephaline and Schizogregarines, but this present paper includes the synthetic results about my studies on Cephaline gregarines. In order to complete the synthetic list on the Japanese gregarines those diagnostic descriptions which I have observed on the parasites or the original reports about the gregarines subjected by other investigators, namely ISHII (1911—1915), IITSUKA (1923), HUKUI (1939—1953) and OBATA (1953), have been incorporated into the present thesis.

MATERIAL AND METHODS

I have widely collected different kinds of host animals; Polychaeta, Crustacea, Diplopoda, Chilopoda and Insecta, within the extensions aria of Yamaguchi, Hiroshima and Ehime prefectures, Japan and especially those procured in Hikari City and its suburbs, Kumage-gun and Kuga-gun.

The host animals captured for the purpose were brought in the laboratory and were kept for two or three days in the glass vessels. Careful consideration was given to keep in proper humidities especially such animals as insects and myriapodes; I obtained favourable results when I kept them in the vessels with some pieces of wet paper or with some hard fresh leaves. The aquatic animals were naturally kept in fresh water or in sea-water as are required. Sea-water was changed once a day in order to prevent them from dying or weakening from the putrefaction of organic matters in it or for want of oxigen. In any case, except in a special one, they were left alone without any food to make them excrete what contents they had in their digestive orgäns. The excrements were all gathered and examined closely or put on slide-glass. The slide-mount was carefully examined on a stage through the low-power binocular microscope. When percived any cyst in it, it was extracted with a couple of fine needles and a slender pipette. The extracted cysts were put on a hollow slide or a slide. They were kept in the wet chamber with the proper kinds of medium and were kept in observation. As a medium distilled water or RINGER's solution was used for that purpose. These cysts, as time passed, gave

out spores. It generally took more days in winter season than in summer season for those spores to be given out. It, however, depended upon species and not regular. Therefore, it so happened that some gave out spores after three months.

It is extremely important to observe the parasites under their live and fresh condition. When the host animals could be obtained in large number, some of them were kept as stated above, and the others were operated to extract parasites from them and were observed and the number of parasites were carefully measured.

The following is the process to extract parasites: The head of the host or the extreme end of its body is to be cut off at its farthest end and to pull out its digestive organ from the cut end of the rest. The taken-out digestive organ is to be taken into a watch glass if is large enough in size, and if not, to be put on a slide and then kept in normal salt solution or RINGER's solution. The digestive organ is then to be torn lengthwise with a pair of fine needles and the parasites will come out of it with the solution in the organ and its contents into the medium.

Sometimes it is to bo perceived that a number of parasites are stuck hanging down on to the wall of the host gut or of the other organ. The parasites set free are to be observed and measured without cover glass over them. When using a cover glass, some fine pieces of tissue or a small thin sheet of paper is required to be put in between the slide and the cover glass so as not to give a press on them. Measurements are kept on through the ocular micrometer and the drawings are made with camera lucida.

RINGER's solution, which is in most cases preferred as the best medium for observing the body of the parasite without causing any change in its shape for a fairly long time, is used at the density from 0.5% to 0.9%. Good results are obtained for staining the living body with 0.01% neutral red solution or with 0.5—0.01% methylen blue solution.

For the smear methods, the cover glass may be smeared with a bit of egg alubumen and the gregarines are brought upon it by means of a capillary pipette from the medium. After the excess water is drawn out by blotting paper, one or two drops of the fixing agent are dropped upon it or the cover glass is plunged into fixations. The study of totos was carried out as far as possible with sections, which were cut from 5μ to 15μ. On the whole, the thicker the sections were, the more useful.

The following fixative agents were used for smears and sections; SCHAUDINN's, BOUIN's, ALLEN-BOUIN's and ZENKER's solutions. ALLEN-BOUIN's solution was found to be best in some cases, especially for fixing the cysts and spores. Various stains were used: HEIDENHEIN's iron haematoxy-

lin, DELAFIELD's haematoxylin, Eosin and Orang-G. HEIDENHEIN's and DELAFIELD's haematoxylin were the satisfactory stains.

DESCRIPTION OF CEPHALINE GREGARINES

Family LECUDINIDAE KAMM, 1922.

Genus *Lecudina* MINGAZZINI, 1891.

1. *Lecudina longissima* HOSHIDE, 1944.

(Figures: 1, 2, 13, 14 ,15)

Diagnosis: Sporonts solitary, lance shaped, measured 300—450μ x 60—80μ. Cepalonts elongate cylindrical, attaining 800μ x 30μ, rounded at the anterior end and sharp pointed at the posterior. Nucleus spherical or ellipsoidal, with two or several karyosomes. Epimerite small simple hyaline knob. Early intracellular stage is known. Cyst spherical, 110μ in diameter, dehisces by simple rupture. Spore ovoidal, 6μ x 10μ.

Host: *Lumbriconereis japonica* MARENZELLER. Polychaeta, Chaetopoda.

Habitat: Intestine.

Locality: Obatake, Oshima, Hikari (Yamaguchi Prefecture).

2. *Lecudina mammilata* HOSHIDE, 1944.

(Figure: 3)

Diagnosis: Sporonts solitary, ovoidal, measured 120μ x 55μ, early intracellular stages are known. Epimerite small hyaline papilla. Nucleus spherical with one spherical karyosome. Projected in mammiliform at the anterior end and pointed at the posterior. Cysts spherical, 95μ in diameter, dehisce by simple rupture. Spores ovoidal 6μ x 4,5μ.

Host: *Nereis japonica* IIZUKA, *N. mictodonta* MARENZELLER. Polychaeta, Chaetopoda.

Habitat: Intestine.

Locality: Hiroshima (Hiroshima Prefecture), Oshima, Obatake. Yanai (Yamaguchi Prefecture).

3. *Lecudina arabellae* n. sp.

(Figures: 10, 11, 12) :

Diagnosis; Sporonts solitary, elongate spindrical, obese. Maximum length 800μ, maximum width 110μ. Subglobularly rounded at the anterior end and acutely pointed at the posterior. Nucleus spherical, 30μ x 25μ, with 2—4 karysomes. Epimerite a small spherical papilla. Cysts and spores unknown.

Host; *Arabella iricolor* (MONTAGU) Polychaeta. Chaetopoda.

Habitat; Intestine.

Locality: Ōbatake, Murozumi (Yamaguchi Prefecture).

Not very infectious ; Only 7 or 8 percent of the worms were found parasitized and the number of gregarines per host was 5—10, (According to my observation in summer, 1952).

Sporont :

The full-grown parasite is solitary. The body is elongate, spindle shaped in outline. It is sometimes asymmetrical, one side more swollen or slightly bent in a crescentic shape. The largest individual 800μ in length and 110μ in width. No differentiation of the segment in the body. The anterior region is constricted in a subglobular form and the body broadens gradually to the middle where its body in genarally widest. Here it tapers again gradually to the acutely pointed slender posterlor end. The widest part of the body is not definite and occasionally differs according to individuals: In one specimen it is situated at a little anterior from the middle and in another slightly below the middle.

The pellicle appears uniformly thick, measuring 2μ in thickness. The endoplasm is dense and opaque, finely granulated in the main part of the body except the subglobular anterior region just below the top. This region presents almost transparent homogeneous consistency, but several large spherical hyaline bodies are often seen there. There is no definite septum separating this region from the rest of the body. In the fresh condition numerous fine circular folds are discernible over the body surface, especially over the subglobular anterior region. These folds are heaved by contraction of the well-developed myonemes which are indicated by a series of delicate reticular fibrillae embedded in the peripheral layer of the endocyte, running crosswise in the body.

The nucleus is spherical or somewhat ovoidal in shape, measuring 30μ × 25μ in average size, and is usually situated about one-fifth anterior end of the body; Its position, however, is apt to be changeable, and it containg two or four large deep stained karyosomes in it. Following are the figures for a few individuals measured. (Dimensions are given in microns);

Number of Specimen	Length of Body	Width of Body	Nuclear diameter	Number of karyosomes
1	348	48	22×17	3
2	437	72	20×20	3
3	470	80	25×22	2
4	488	82	30×22	2
5	540	87	32×24	3
6	564	95	32×24	3
7	630	90	22×20	4

The movement :

It is fairly active. Its whole body usually moves gliding with its anterior end twisting. In other words it keeps on nodding all the time in the same manner. Many cicular folds rise over the surface of the body, especially over this subglobular anterior region and also near the portion while the parasite is moving thus.

Cephalont :

The smallest trophozoite ever found in sections was ovoidal in shape, attaching to or burying half the body in the epithelial cell of the host intestine. It measured $30\mu \times 20\mu$ in size. The epimerite has not yet developed in this stage.

With age the parasite grows in size and its form turns gradually into that of the sporont as was described above. The trophozoite which attains to 50μ usually has an epimerite at the anterior end of the body. The epimerite persists long and it is odserved even among well developed individuals, or sometimes among free ones. The epimerite is a simple, small and spherical papilla, by means of which the cephalonts sticks to the gut wall. It is able to be lengthened together with the anterior part of the body or on the cotrary invaginated into the main body.

Systematic position

Although it has not yet been observed all through its life, the species is plainly assigned to the genus *Lecudina*, because the body is non-septate, the epimerite is simple, small and spherical papilla and the host belongs to the polychaete worms.

Among the members of the genus *Lecudina* this species bears the closest resemblance to *L. longissima* (TUGAWA) in its size of the cephalont and in the characteristic features of its anterior part of the body, but is easily distinguishable from the latter in its body differently shaped. In *L. longissima* the body is elongate cylindrical, but in this species it is spindrical, obese and is much wider than the latter; and in the characters of nucleus, which in *L. longissima* is spherical or symmetrically elliposoidal in shape but in this species it is spherical or asymmetrically ovoidal and larger than the nucleus of the latter species.

4. *Lecudina amphora* n, sp.

(Figures: 16, 17, 18)

Diagnosis: Sporont solitary, elongate vase-shaped, Maximum length 1700μ, maximum width 250μ. Broadly conical at the anterior end and pointed at the posterior. Nucleus spherical, 60μ in average diameter, with 4–5 karyosomes. Cysts and spores unknown.

Host: *Glycera rouxii* AUDOUIN & EDWARD, *Glycera* sp. Polychaeta, Chaetopoda

Habitat: Intestine.

Locality: Oshima, Naruto (Yanaguchi Prefecture)

This gregarine was rather rarely to be found in those districts mentioned above.

Out of 69 worms or *Glycera rouxii* which were examined, only 7 yielded parasites. The other host worm, *Glycera* sp., which is smaller than the former and is reddish or greenish orange, is far less parasitized by this gregarine, out of a hundred worms examined only four were found. The infection was not very heavy and only several trophozoites were found in each of the hosts during the summer, 1945.

The parasites live in the anterior middle portions of the gut, and are always stuck to the epithelium by their epimerites. The epimerite is a small conical papilla on the anterior dome-shaped projection of the main body segment.

In fresh condition a full-grown sporont is elongate vase-shaped in outline, but its shape is changeable contracting and extending the body. The largest individual measured 1700μ in length and 250μ in width. The anterior region is broadly cone-shaped, dilated a short distance below the anterior end and slightly constricted below this dilated part. It widens so gradually to the middle portion from this constriction which is situated in about one tenth of its length from the anterior end. The widest part is generally in the middle or slightly below. The body tapers gradually from here towards the posterior end, terminating in a pointed extremity.

Following is a table of the various dimensions of some trophozoites given in microns:

Number of specimen	Length of body	Width of body	Diameter of nucleus	Number of karyosomes
1	210	37	20	3
2	450	80	30	3
3	1100	120	45	4
4	1254	155	55	4
5	1270	230	62	4
6	1500	180	60	5

There is a rather thick pellicle, measuring about 5μ in thickness, which is longitudinally and circularly grooved. The pellicle is much pressed to be thinner at the bottom of the grooves which stain deeply with haematoxylin. The cytoplasm is very dense and brown in transmitted light. It is finely

granulated in the main part of the body, except in the anterior half of the cone-shaped projection. In fresh condition this region presents a homogeneous hyaline consistency of the cytoplasm although there is no septum separating the anterior end from the main body. In permanent preparations the anterior half stains homogeneously palish blue with haematoxylin, where as the main body appears lighter and thickly granulated. The myonemes are well developed. Especially the longitudinal striations are seen at the anterior region immediately below the apex, except circular ones which are seen at the main part of the body. The layer of circularly disposed fibrils lies beneath the longitudinal grooves in the main body. The shape of the body when alive varies according to the contraction of these fibrils. When the parasite taken out of the gut lumen by teasing the host worm with a fine pair of needles is observed in a medinm of saline, it moves in two manners of movement. It is very active under these conditions. It moves on gliding without any change in its shape or changing the shape. The anterior cone-shaped region is changing actively in outline, making an amoeboid movement.

The nucleus is spherical in the normal trophozoites, but it is deformed when the parasite is in active movement. It measures 60 μ in average diameter in the full grown trophozoites. The nucleus is placed generally a little below the constriction, though, its position changeable. It is sometimes situated near the anterior end or near the posterior end. It is invisible in dense adults but visible in young specimens. There are 4 or 5 karyosomes within. They are spherical in outline and generally vacuolated.

Systematic position:

Among the members of the genus *Lecudina*, *L. legeri* (BRASIL) KAMM is the only species that has hitherto been reported as the one parasitic on the genus *Glycera*. This European form is much smaller than *L. amphora* n. sp.. It shows very peculiar features in many respects: The shape of the body, the shape of the anterior portion of the main part of the body, well developed myonemes and especially marked circular striations, worthy of being classified as a new species.

5. *Lecudina fluktus* IITSUKA, 1923.

Diagnosis: Sporonts elongate, irregular spindle-shaped, body surface with wavy or warty projections. Measure 400-700 $\mu \times 90\mu$. Epimerite nipple-shaped, constricted at the base. Nucleus spherical. Cyst spherical, measuring 500 μ in diameter, envelope thick, 40 μ in thickness. Spores cystiform or ovoidal, 10 $\mu \times 6\mu$.

Host: *Urechus unicinctus* von DRASCH. Echiuroidea, Chaetopoda.

Habitat: Intestine.

Locality: Hiroshima (Hiroshima Prefecture).

Genus *Cochleomeritus* HOSHIDE, 1944.

6. *Cochleomeritus lysidici* HOSHIDE, 1944.
(Figures: 6, 7)

Diagnosis: Sporonts solitary, spoon-shaped. Maximum length 525μ, maximum width 150μ. Broadly rounded at the anterior end and sharply pointed at the posterior, 3 or 4 ridges on the surfaee. Nucleus ellipsoidal, 40—30μ in diameter, with one karyosome. Epimerite pin-shaped with a long stalk. Cyst and spores not known.

Host: *Lysidice punctata* RISSO. Polychaeta, Chaetopoda.
Habitat: Intestine.
Locality: Obatake, Hikari (Yamaguchi Prefecture).

Genus *Ferraria* SETNA, 1930. (corrected)

Sporonts, dicysted, bottle-shaped. Epimerite wide mouthed, funnel like structure on a long tubular stalk.

7. *Ferraria cornucephala iwamusi* HOSHIDE 1944. (=*Cotyloepimeritus iwamusi*)
(Figures: 4, 5, 9)

Diagnosis: Sporonts solitary, bag- or turtle-shaped, measure 220—380μ × 170—210μ. Endocyte granular, epicyte thick, with 4—5 ridges on the surface. Nucleus spherical or ellipsoidal, with one large karyosome. Cephalont bottle shaped. Epimerite a cup-shaped on the long elastic stalk, measured 20—50μ in length. Cyst spherical, 300μ in diameter, dehisce by simple rupture. Spores spherical, 9μ in diameter.

Host: *Marphysa iwamusi* IZUKA. Polychaeta, Chaetopoda.
Habitat: Intestine.
Locality: Hiroshima, Itsukushima (Hiroshima Prefecture), Obatake, Hikari (Yamaguchi Prefecture).

Trophozoite:

The trophozoites stick to the gut wall by means of their epimerites in its young stage. The epimerite consists of two parts: an apical cup-shaped apparatus and a long slender elastic stalk. The former apical apparatus is widely mouthed and closely adheres to the surface of the epithelial cell. The latter stalk is tubular and is variable in length according to its elasticity. When it extends itself it measures 50μ, showing fine longitudinal grooves on the sur-

face and when contract itself it presents numerous circular grooves, measureing 20μ in length.

Fairly developed trophozoites are bottle-shaped and somewhat flattened, showing a slight ellipsoidal outline in cross section. The main part of the body seemes to be divided into two parts corresponding to the protomerite and deutomerite of the tricysted gregarine with pseudoseptum. This septum, which situates at one fourth of its length from the anteior end, is a clear area devoid of the endoplasm. This clear area becomes apparent by the more pressure of the body wall which falls deeply on both sides at this region, so it is entirely different from the true one which consists of sarcocyte.

The anterior part above this septum is elongate ovoidal and is well rounded or rather truncated at the anterior end. It widens gradually from the top and is widest at the base. The posterior part below this septum is roughly ovoidal in outline and widest in the middle, tapering from this spot to a broadly rounded posterior end. But there is a small conical projection at the center of this posterior rounded surface in normal individuals.

A table of measurments of some trophozoites is as follows (all the dimensions are given in microns):

Number of specimen	Total length	Width of body	Length of epimerite	Size of nucleus	Size of karyosome
1	210	62	12	25×20	8× 8
2	360	102	20	32×30	12×12
3	330	120	25	38×35	11×11
4	410	145	22	40×35	12×11
5	460	180	25	60×50	12×12

Sporont :

The sporonts are solitary and conparatively broader than the cephalonts. The body is generally flattened bag-shaped or turtle-shaped, being widest at one-third of its length from the anterior end and tapering from here towards the posterior blunt pointed extremity. The anterior end is boadly rounded, though, a small conical projection is descernible at the apex.

Four or five pelliclar ridges connecting both anterior and posterior extremities are seen on the surface of the body. In the younger stage of sporonts these ridges are incospicuous but they develop with age in to several longitudinally sectioned parts of the body.

The following is a table of measurements of some sporonts (all dimensions are given in microns follows):

Number	Body length	Body width	Nuclear size	Karyosome size	Epimerite length
1	220	170	40×38	12×11	15
2	320	200	58×50	12×12	18
3	350	200	48×45	10×10	—
4	360	210	52×50	11×10	—
5	372	192	50×45	12×11	—

The epicyte is rather thin but stout, It is transparent and of even width throughout execept at the ridges where it becomes considerably thicker. The marginal region of the body is quite or nearly transparent, containing but few fine granules of protoplasm. The content of the anterior region immediately below the apex is finely granular, homogeneous and often so dense as to appear brown in transmitted light. The central main part of the body is dense and full of numerous vacuoles which are less in number in younger stage.

The nucleus is visible in vivo, and it is spherical or ellipsoidal in shape. It lies generally in the middle or slightly below the middle, measuring 40—55 μ in diameter. There is one large spherical karyosome in it. Moreover several chromatin granules, which are stained deeply with harmatoxylin, are visible within.

The parasite is fairly active. Beside the simple gliding movement, a twisting or contorting movement is commonly seen. When the animal come across an obstacle while moving. it changes the shape of the body by contraction and expansion of the myonemes to pass through the place avoiding the obstacle.

Cyst and spore :

Two matured sporonts attach themselves to their anterior ends or to their sides and begin to rotate around the common axis. Then they come closer and closer together forming a spherical cysts. The cysts are found in the host intestine or in the excrements. It measures 300 μ in average diameter and is covered with an outer membrane. which is transparent and measures 10 μ in thickness.

The spores are spherical and measure 9 μ in diameter. They are extruded by simple rupture.

Systematic position :

SETNA. S. B. (1930) found two different parasites from the same polychaete worm, *Morphvsa sanguinea* MONTAGUE collected at Port Blair, Andamans. He created new genera for them; *Bhatiella morphysae* and *Ferraria cornucephala*, the former classified into the family Lecudinidae and the latter into the family Polyrhabdinidae.

I discovered a parasite which resembles to the above from *Marphysa iwamusi* IZUKA and reported as *Cotyloepimeritus iwamusii* in 1935. This japanese form is

considered to be treated as a member of the genus *Ferraria*, because the character of epimerite and the form of the body are identified with those of the type species. The septum considered by SETNA to be a true one in the Indian form is a false one from my point of view, as described above, on the Japanese form.

In this Japanese species, moreover, the characters and forms of the two genera, *Bhatiella* and *Ferraria*, which have been considered to be different from each other, are now classified some intermediate specimens, then under the genus by the entry of several intermediate specimens between these two. I consider the genus *Ferraria* should be transferred to the family Lecudinidae.

This species differs from the *F. cornucephala* in size of body, epimerite, and nucleus and in characters of sporont; in the latter the maximum size is $300\mu \times 90\mu$ but in this species $480\mu \times 185\mu$: in the latter the size of the nucleus is $31\mu \times 31\mu$ but in this species $50\mu \times 40\mu$; in the latter the length of epimerite is 18μ but in the former 50μ.

Family POLYRHABDINIDAE KAMM 1922

Genus *Sycia* LEGER 1892

8. *Sycia cirratuli* n. sp.
(Figures: 19–23)

Diagnosis: Sporonts solitary, ovoidal, flattened. Measure $95\mu \times 55\mu$ in average size, Ratio of LP : TL = 1 : 5.2. WP : WD = 1 : 1.6. Protomerite subspherical, constricted at septum. Deutomerite ovoidal widest in middle, posterior end bluntly pointed. Nucleus spherical with one karyosome. Epimerite gourd-shaped on a short stalk. Cyst spherical, 80μ in diameter. Spores unknown.

Host: *Cirratulus cirratus* O. F. MULLER. Polychaeta, Chaetopoda.

Habitat: Intestine.

Locality: Ōshima, Ōbatake (Yamaguchi Prefecture)

Sporont:

Sporonts are solitary, ovoidal in shape and somewhat flattened. The protomerite is subspherical, widest at the base and tapers gradually towards the anterior end, well rounded or rather flattened at the apex. There is a definite septum between the protomerite and the deutomerite but constriction is never to be discerned there. The deutomerite is ovoidal, widening gradually from the septum to the middle portion of the body, where it is widest. It tapers from here gradually to the bluntly pointed posterior extremity. Several longitudinal ridges often run on the surface of the posterior half of the deutomerite.

The largest sporont found was 180μ in length and 48μ in width. The indi-

viduals are averaged 95μ in length and 55μ in width. The average ratio of length protomerite: total length sporont = 1 : 5.2 and the ratio width protomerite: width deutomerite = 1 : 1.6.

The nucleus is spherical, generally in diameter half one-third the width of the deutomerite. It is conspicuous in parasites of all ages containing one spherical karyosome each. The epicyte is rather thick and it is considerably thicker on the anterior terminal region and at the place of septum and also a little thicker on the side of the posterior region of the deutomerite than the rest of the body.

A table of measurements of some parasites, including sporonts and cephalonts is as follows (all dimensions are given in microns):

Sporont:			
Total length of sporont	165	102	95
Length protomerite	30	24	20
Length deutomerite	135	78	75
Width protomerite	35	39	32
Width deutomerite	50	54	57
Ratio of LP : TL	1 : 5.5	1 : 4.3	1 : 4.6
Ratio of WP : WD	1 : 1.4	1 : 1.4	1 : 1.8
Diameter of nucleus	25	18	20
Cephalont			
Total length cephalont	67	63	51
Length protomerite	17	18	16
Length deutomerite	50	45	35
Width promerite	27	28	26
Width deutomerite	41	44	35
Ratio of LP : TL	1 : 3.9	1 : 3.5	1 : 3.2
Ratio of WP : WD	1 : 1.5	1 : 1.6	1 : 1.3
Diameter of nucleus	18	17	15
Size of epimerite	25×34	20×30	20×40

The body is brown, the protoplasm not so dense as that of many gregarines. The protomerite is less dense and tan in colour, containing coarse granules in it, but the deutomerite is homogeneous and finely granulated. Almost transparent small region is to be seen at the anterior portion immediately below the apex.

Movement ia not active, but it glides slowly in the saline when it is taken out of the host intestine.

Cephalont.

The smallest trophozoite found in the smear preparate was subspherical and measured 40μ in the total length including the epimerite. The body is

already differentiated in three segmentes: protomerite, deutomerite and epimerite.

The young cephalont is provided with a characteristic epimerite of which anterior half is inserted into the epithelial cell of the gut. The epimerite is roughly gourd-shaped in outline and attached with a short stalk to the apex of the protomerite. The anterior half of the epimerite is subspherical and its surface is uneven with numerous small papillae; the posterior half varies in shape by means of its elasticity. It is extended or contracted, adjusting the situation of the parasite to the wall of the digestive tract. In some specimen it makes its appearance in a collar surrounding the neck as the type species described by LEGER. But in other ones, it is extended and becomes elongate ovoidal-shaped.

The protomerite is subspherical and is as same as that of an adult. The deutomerite in trophozoite stage is ovoidal and widens gradually to the posterior portion. It is widest near the end of the deutomerite and is broadly rounded at the posterior extremity.

In one occassion I found a spherical cyst, measuring 80 μ in diameter among the mature sporonts in the host intestine but I could not observe it more developed.

Systematic position:

This gregarine may be assigned to the genus *Sycia* LEGER 1892 on account of the similar shape of the epimerite and the character of the body: divided into three segments.

The cephalont of this species resembles superficialy to that of the type species, *S. inopinata* LEGER 1892 but differs from the latter, in the character of epimerite, consisting of the elastic lower half and in the ratio of length protomerite to total length. The shape of the body is also different from cach other of these two species.

Family CEPHALOIDOPHORIDAE KAMM, 1922.

Genus *Cephaloidophora* MAWRODIADI, 1908.

9. *Cephaloidophora communis* MAWRODIADI

Host: *Balanus amphitrite albicostatus* PILSBERY. Cirripedia, Crustacea
Habitat: Intestine.
Locality: Hikari, Naruto, Iwakuni (Yamaguchi Prefecture). Hiroshima (Hiroshima Prefecture).

Sporont

The sporonts are biassociative as adults. The mature sporont reaches the

length of 110μ. The largest association observed was 250μ in length and 50μ in width. The primite is generally as long as or longer than the satellite.

(Primite) The ratio of LP : TL = 1 : 3.1—3.6, WP : WD = 1 : 1.1—1.2. The protomerite is hemispherical and widest in the middle. There is a thickened crescentic hyaline disc at the anterior end of the protomerite. The constriction at the septum is conspicuous. The deutomerite is ellipsoidal, widens gradually from the septum and is widest at the middle region, tapering to a broadly rounded posterior extremity.

(Satellie) The protomerite of the satellite fits into the deutomerite of the primite but the interlocking device is well constructed, sporonts of an association being not easily dissociated by slight pressure. The satellite is elongate ellipsoidal in shape and its shape and size are almost as same as those of the primite.

A few typical measurements in microns are given below.

Total length association	206	181	195	165	178
Primite:					
Total length sporont	104	100	100	96	98
Length protomerite	29	32	28	30	28
Length deutomerite	75	68	72	66	70
Width protomerite	35	32	32	33	38
Width deutomerite	42	39	38	37	44
Ratio of LP : TL	1 : 3.6	1 : 3.1	1 : 3.6	1 : 3.2	1 : 3.5
Ratio of WP : WD	1 : 1.2	1 : 1.2	1 : 1.2	1 : 1.1	1 : 1.2
Satellite:					
Total length sporont	102	81	95	59	87
Length protomerite	24	25	27	19	30
Length deutomerite	78	56	68	50	57
Width protomerite	39	34	40	30	32
Width deutomerite	42	39	45	36	36
Ratio of LP : TL	1 : 4.3	1 : 3.2	1 : 3.5	1 : 3.6	1 : 2.9
Ratio of WP : WD	1 : 1.1	1 : 1.1	1 : 1.1	1 : 1.2	1 : 1.1

The body is palish brown or dark brown in colour, or of not equal density in protomerite and deutomerite; The protomerite is lighter with large, sparsely scattered protoplasmic granules, the deutomerite is homogeneous and darker, consisting of fine granules.

The nucleus is spherical, measuring 18μ in average diameter and contains one to several karyosomes within.

Movement is active and both gliding and bending movements are commonly observed, the rotating just before the cyst formation is exhibited very actively.

Cyst and spore

The cysts are spherical, measuring 80 μ in average diameter. The spores are extruded by a simple rupture of the cyst and are ovoidal in shape.

10. *Cephaloidophora setoutiensis* n. sp.
(Figures: 31—41)

Diagnosis: Sporonts biassociative, ovoidal. Maximum length of sporonts 80 μ, width 35 μ. Ratio, LP : TL=1 : 3.3, WP : WD=1 : 1.3.

Protomerite hemispherical, with a lens shaped body at anterior end. Deutomerite ovoibal, widest in middle. Nucleus spherical, 9 μ in diameter, contains one karyosome. Cyst spherical, average 40 μ in diameter. Spores spherical 4.5 μ in diameter.

Host: *Orchestia platensis* KROYER Amphipoda, Crustacea.

Habitat: Intestine.

Locality: Obatake, Hikari, Iwakuni (Yamaguchi Prefecture), Hiroshima, Itsukushima (Hiroshima Prefecture).

During the autumn of 1953, parasitism was found to occur in almost 40% of the 110 individuals examined, but in April, 1954, I found that almost all the beach fleas proved to be infected by this species at Hikari-city. The infection was considerably heavy, as many as two hundreds parasites seen in each of several hosts, and each of the others examined contained good many parasites.

Sporont.

The sporonts are biassociativc, and the association period seems to be short and they form syzygy for a little while just before the cyst formation. The maximum observed length for an association was 140 μ. The largest sporont was 80 μ and 35 μ wide. The sporonts are ovoidal in shape.

(Primite) The average ratio of LP:TL=1:3.3, WP:WD =1:1.3. The body is ovoidal in shape and it becomes broader as it develops into maturation to an almost globular form. The protomerite is hemispherical, widest a short distance above the base, and usually wider than it is long. It terminates in a well rounded anterior extremity. There is a lens-shaped, thickened area at the anterior end of the protomerite, which measures generally 12—15 μ in width and 5—7 μ in length. About one-fourth of this disc usually protrudes above the surface and the other part is embedded in the center of the anterior end of the protomerite. There is a slight constriction at the septum. The deutomerite is ovoidal broadening rapidly backwards from the septum and attaining its greatest width in the middle. The part where it is widest is not definite; it is sometimes slightly above or below the middle. From here the deutomerite

gradually contracts, very broadly rounded, rather truncated at the posterior extremity.

(Satellite) The average ratio of LP : TL = 1 : 3.1, WP : WD = 1 : 1.3. The interlocking device of both individuals is well developed. The posterior end of the primite fits intimately into the shallow concavity of the apex of the satellite. A clear lens-shaped area is also discernible at the center of the jointing plane of primite and satellite. The protomerite is slightly depressed at the apex. The constriction at the septum is shallow. The deutomerite is ovoidal and is alomost as same as that of the protomerite in shape, and it is generally widest at the end of the anterior third of the body. Thence it tapers gradually to a broadly rounded posterior end, where it is often flattened.

A table of measurements follows in which all dimensions are given in microns:

Total length of association	56	53	130	138	132
Pritmite:					
Length of sporont	34	26	55	68	75
Length protomerite	10	8	18	20	22
Length deutomerite	24	18	37	48	55
Width protomerite	12	10	18	22	25
Width deutomerite	15	13	22	27	35
Ratio of LP : TL	1 : 3.4	1 : 3.3	1 : 3.1	1 : 3.4	1 : 3.4
Retio of WP : WD	1 : 1.3	1 : 1.3	1 : 1.2	1 : 1.2	1 : 1.4
Diameter of nucleus	6	6	8	9	10
Satellite:					
Length of sporont	22	27	75	70	57
Length protomerite	7	7	25	22	18
Length deutomerite	15	20	50	48	49
Width protomerite	9	9	20	22	20
Width deutomerite	10	11	27	30	25
Retio of LP : TL	1 : 3.1	1 : 3.9	1 : 3.0	1 : 3.2	1 : 3.2
Ratio of WP : WD	1 : 1.1	1 : 1.2	1 : 1.4	1 : 1.4	1 : 1.3
Diameter of nucleus	5	6	10	10	9

Measurements of some solitary individuals seen as follows:

Total length sporont	38	46	52	55	60
Length protomerite	13	15	17	18	20
Length deutomerite	25	31	35	37	40
Width protomerite	15	20	20	23	22
Width deutomerite	17	24	26	30	28
Ratio of LP : TL	1 : 2.9	1 : 3.1	1 : 3.1	1 : 3.1	1 : 3.0
Ratio of WP : WD	1 : 1.1	1 : 1.2	1 : 1.3	1 : 1.3	1 : 1.3

In the mature sporonts, the endoplasm appears brown in transmitted light. The deutomerite is somewhat darker in colour and contains smaller homogeneous fine granules. The protomerite is lighter, containing coarse large granules, evenly distributed in its endoplasm. The epicyts is rather thin but stout. It is transparent, of even width throughout except the anterior region of the protomerite.

The nucleus is visible in vivo; it is spherical and measures 9μ in average diameter. It lies most of ten eccentrically just below the septum, containing one spherical karyosomes within.

The parasite is fairly active. Gliding movement, accompanied by no bodily contortion was commonly observed at rates of 6μ and 4.5μ per second. Each rate was kept constantly for a while, but sometimes, the parasites progressed often intermittently. Just before the cyst formation, associated individuals progresses sluggishly forwards, but they show active contortion of their bodies or alter their shape according to the amoeboid movement.

Trophozoite

The intra-cellular trophozoites are commonly seen in both sections and smears. This stage is relatively long in this species. The smallest trophozoite is spherical in shape and measures 10μ in diameter. The body segments have never been differentiated in this stage but both segments, protomerite and deutomerite, appear in the individual 15μ long. The trophozoites, which have just passed the intra-cellular stage, are found in the gut lumen. These are free in the lumen because the epimerite is rudimentary. These trophozoites are in various stages of growth, and consequently vary considerably in size, the smallest one being 13μ×7μ.

Cyst and spore

The cysts collected from the posterior region of the midintestine or from the excreta are spherical or somewhat ellipsoidal in shape, and measure between 30μ and 45μ in total diameter. At the beginning of cyst formation two associative individuals commence to revolve together or one of them begins to transform the body gradually into a cup-shape and envelopes the one end of the other. The two sporonts finally come to lie in contact laterally forming a compact sphere. As the animals are forming the cyst, a thin transparent covering is being laid down on the outside of the cyst.

The spores are extruded from the cyst by simple rupture and they are spherical in shape, measuring 4.5μ in diameter. One large spherical residual, central body and sporozoites are visible within.

Systematic position.

Among the members of the genus *Cephaloidophora*, this species bears some resemblance to *C. orchestiae* POISSON 1924 in the following points: the length of the body is commonly 55—70 μ; the protomerite is hemispherical; the nucleus is hemispherical and contains one spherical karyosome within; the cyst is spherical, measuring 30 μ or more in diameter; the spore is spherical. This species, however, differs from the latter in the following points: the maximum length is 80 μ, (the latter 140 μ); the primite is not always larger than the satellite; the ratio of LP : TL is 1 : 3.0—3.5, (The latter, the ratio of LP : TL is rather less than 1 : 2.5, measured the PPOISSON's sketch); the diameter of the spore is 4.5 μ, (the latter 6.5 μ).

This species resembles also *C. talitri* MERCIER 1911 and *C. maculata* LEGER et DUBOSCQ 1910 and *C. ampelisca* (NOWLIN & SMITH) KAMM in size of the body but it differs from them in shape and ratio of various parts of the body.

11. *Cephaloidophora punctata* n. sp.

(Figures : 25—30)

Diagnosis: Sporonts biassociative, elongate cylindrical to ovoidal. Length of association; 100 μ to 420 μ. Maximum length of sporont; 230 μ, width; 105 μ. Ratio, $\frac{LP:TL}{lp:tl} = \frac{1:4.5}{1:5.4}$, $\frac{WP:WD}{wp:wd} = \frac{1:1.2}{1:1.2}$. Protomerite hemispherical, with lens shaped disc at anterior end. Deutomerite ellipsoidal to ovoidal, widest below middle. Nucleus spherical 20 μ in diameter, with one large karyosome. Cyst spherical, 80—100 μ in diameter. Spores spherical 10 μ in diameter.

Host: *Ampithoe japonica* (STEBBING) Amphipoda, Crustacea.

Habitat: Intestine.

Location: Hikari, Naruto (Yamaguchi Prefecture).

In spring the hosts are easily captured among pebbles on the seashore of Murozumi Bay. Two different species of gregarine are generally parasitic in the same host, but during the March of 1951 I found this species sheltering more frequently than the other in the gut of the host. Out of the sand hoppers examined 60% were parasitized but the infection was not so heavy.

Sporont

The sporonts are biassociative in two. The largest sporont found was 230 μ in length and 105 μ in width. The maximum length observed for an association was 420 μ, but the smallest one seen was 100 μ in length. The two sporonts may form asyzygy in their rather earlier stage of development.

(Primite) The body is ellongate cylindrical in the young sporonts and is almost ovoidal in the fully matured ones. The average ratio of LP : TL = 1 : 4.5,

WP : WD = 1 : 1.2. The length of the primite is generally longer than that of the satellite but in some specimens both are of the same length. The protomerite is hemispherical well rounded at the anterior end and widest at the base. There is a slight or no constriction at the septum. The deutomerite is ellipsoidal, widening gradually from the septum and is widest just below the middle. It tapers from thence to the posterior portion, ending in a broadly rounded posterior extremity.

The structure of the protomerite is similar to other members of the genus. There is a thickened lense-shaped disc, 30—35 μ in width and 10—15 μ in length, embedding in the center of the anterior end of the protomerite.

(Satellite) The deutomerite of the primite fits into the anterior end of the satellite and the interlocking device between the sporonts is well developed. The average ratio of LP : TL = 1 : 5.4, WP : WD = 1 : 1.2. The protomerite is somewhat flattened, being about one and half times as wide as its height and is a little shorter than that of the primite. The deutomerite is ellipsoidal to elongate cylindrical, being of same width throughout in the early stage of development. It is broadly rounded at the posterior extremity.

The epicyte is thick and especially so near the septum and at the anterior region of the protomerite. The body is brown in transmitted light. The protomerite is paler than the deutomerite, containing a few large, coarse granules. The deutomerite is dark and dense and contains fine, homogeneous granules. The granules in the body is much coarser and better stained by haematoxylin than in other species of gregarines found from Amphipoda by the writer.

There are often many small or rather large chromidial bodies sparsely scattered in the endocyte of the body throughout. These bodies are generally irregular in shape, being deeply stained with haematoxylin.

The nucleus is spherical in shape, measuring 20 μ in average diameter and 28 μ in diameter of large specimens. It is visible as in a transparent area even in a dense living specimen. The presence of the nucleus in the deutomerite is visible, but it is most often situated a short distance below the septum. In some specimens the nucleus situates near the posterior end or about the middle. It contains one large spherical karyosome, measuring 10 μ in diameter.

A table of a few typical measurements in microns is given below:

Length association	393	385	302	290	235	199
Primite:						
Length sporont	205	210	142	150	120	126
Length protomerite	38	45	35	32	25	27
Length deutomerite	167	165	107	118	95	99
Width protomerite	70	70	45	50	35	35

Width deutomerite	95	90	60	60	43	40
Ratio of LP : TL	1:5.4	1:4.7	1:4.1	1:4.7	1:4.8	1:4.7
Ratio of WP : WD	1:1.3	1:1.3	1:1.3	1:1.2	1:1.2	1:1.1
Satellite:						
Length sporont	188	175	160	140	115	73
Length protomerite	35	38	30	28	24	14
Length deutomerite	153	137	130	112	91	59
Width protomerite	63	63	50	42	32	23
Width deutomerite	85	83	58	49	40	28
Ratio of LP : TL	1:5.4	1:4.6	1:5.3	1:5.0	1:4.8	1:5.2
Ratio of WP : WD	1:1.3	1:1.3	1:1.2	1:1.2	1:1.3	1:1.2

This gregarine is fairly active. Gliding movement accompanied by bodily contortion is usually observed, which is performed at the ratio of 4—5 μ per second.

Trophozoite

The smallest trophozoite seen in the gut lumen measured in microns as follows: Total length 38, length protomerite 13, length deutomerite 25, width protomerite 15, width deutomerite 18, Ratio of PL : TL=1 : 3.0, WP : WD=1 : 1.2. Diameter of nucleus 10. The body is roughly ovoidal, the protomerite is somewhat pentagonal, widest slightly above the middle and tapers rapidly from there to the apex, ending in a bluntly pointed anterior end. The lens shaped thickened disc, the rudimentary, projects in a small cone. The constriction at the septum is rather deep. The deutomerite is ovoidal widening rapidly from the septum and attaining the greatest width at a short distance below the shoulder. Then it tapers gradually towards the posterior end where it is rather truncated and flattened or rather slightly concaved.

Cyst and spore

Cysts are spherical in shape and measure 80—100 μ in diameter. They developed to completion and dehisced by simple rupture in 36 to 48 hours. The spores are extruded scatterringly and not in chains. The spherical and measures 10 μ in diameter.

Systematic position

This species resembles *Cephaloidophora fossor* (LEGER & DUBOSCQ) TREGOUBOFF 1906 in length of the body, but it differs from the letter in some points as follows; in the former the ratio of LP : TL=1 : 4—5 and WP : WD=1 : 1.2, and in the latter LP : TL=1 : 3—4, WP : WD=1 : 1.1; the nucleus is ovoidal and situated immediately below the septum in the latter and in the former it

is spherical and lies a short distance from the septum or in the former it is spherical and lies a short distance from the septum or in the posterior portion; there is an apparent pore at the apex in the latter species and there is no pore but a lens-shaped, thickened disc at the apex in the form.

It is also similar in size of the body to *C. oceallata*, but it is easily separated from the latter in the ratio of various parts of the body and with no eye-shaped corpuscles both in primite and in satellite.

In the ratio of the body, the species has some resemblance to *C. communis* MAWRODIADI 1908, *C. maculata* LEGER & DUBOSCQ 1910, *C. delphinia* (WATSON) KAMM 1916 and *C. talitri* MERCIER 1911, but it is largest of them all in size.

12. *Cephaloidophora obatakeensis* n. sp.
(Figures 74—76, 79)

Diagnosis: Sporonts biassociatve, ellipsoidal or cylindrical, the couple attain a total length 225μ. Length primite 70μ to 120μ, width 30μ to 40μ. Ratio, $\frac{LP:TL}{lp:tl}=\frac{1:4.0}{1:5.0}$, $\frac{WP:WD}{wp:wd}=\frac{1:1.3}{1:1.1}$. Protomerite subglobular, lens-shaped thickened disc at anterior end. Deutomerite cylindrical widest about middle. Nucleus spherical, 15μ in diameter, with one karyosome. Cyst and spores not observed.

Host: *Talorchestia* sp. Amphipoda, Crustacea.

Habitat: Intestine.

Locality: Ōbatake (Yamaguchi Prefecture).

The host sand hoppers taken at the muddy bottom of the Ōbatake channel were always parasitized by this species, but the infection was not so heavy, only twenty or so parasites were found in each host.

Sporont

The sporonts are biassociative in adults. The maximum length of an association was 225μ. The largest primite was 110μ long and 28μ wide. The body is ellipsoidal or elongate cylindrical in shape.

(Primite) The average ratio of LP : TL = 1 : 4.0, WP : WD = 1 : 1.3. The protomerite is subglobular, widest at a point just below the middle and well rounded at the anterior end. It is about 1.5 times as wide as its length. There is a slight constriction at the septum. The deutomerite is cylindrical, widening gradually from the septum and attaining to the greatest width in the middle or a short distance below the middle. It tapers gradually toward the posterior portion ending in a broadly rounded posterior extremity.

(Satellite) The average ratio of LP : TL = 1 : 5.0, WP : WD = 1 : 1.1. The length of primite is generally, but not always, longer than that of satellite, while,

the width of the former is narrower than that of the latter. The interlocking device between primite and satellite is deep and well developed. The protomerite is very slightly flattened at the top and bottom, and widest at a short distance above the septum. There is but slight constriction at the septum. The deutomerite is elongate cylindrical in shape. It widens from the septum and is widest at a short distance below the septum. From thence the deutomerite tapers very gradually ending in a broadly rounded posterior extremity. In a slightly younger specimen the deutomerite is usually constricted rather conspicuouly just below the middle, forming a slender conical tail, but ending in a well rounded extremity.

Measurements of a few associations with all dimensions expressed in microns are as follows:

Total length association	215	220	213	178	148
Primite:					
Length sporont	100	95	97	103	85
Length protomerite	25	24	25	25	22
Length deutomerite	75	71	72	78	63
width protomerite	40	37	40	37	33
width deutomerite	50	43	52	48	37
Retio of LP : TL	1:4.0	1:4.0	1:3.9	1;4.1	1:3.9
Ratio of WP : WD	1:1.3	1:1.2	1:1.3	1:1.3	1:1.1
Nuclear diameter	16	15	14	15	14
Satellite:					
Length sporont	115	125	105	75	63
Length protomerite	20	25	20	15	13
Length deutomerite	95	100	85	60	50
width protomerite	34	37	33	25	25
width deutomerite	38	42	37	30	28
Ratio of LP : TL	1:5.8	1:5.0	1:5.3	1:5.0	1:4.8
Ratio of WP : WD	1:1.1	1:1.1	1:1.1	1:1.2	1:1.1
Nuclear diameter	13	15	16	12	12

The body is brown in colour, the protomerite of primite is somewhat lighter than the other parts of the body. This portion is light brown, containing a few large deeply staining granules clustered mainly in the lower half, except the anterior portion where it is transparent or nearly so. There is a lens-shaped clear disc immediately below the apex. The deutomerite is evenly dense and darkly coloured, containing smaller homogeneous granules. The ectocyte is rather thick, 4—5μ in thickness, transparent and of even width throughout except at the upper region of the protomerite of the primite it becomes thin.

The nucleus in vivo is not visible in dense adults, but in the younger sporonts and in the trophozoites. It is spherical in diameter about one-third of the width of the deutomerite and contains one karyosome. In an adult specimen the nucleus measures 15 μ in diameter and the karyosome 6 μ in diameter.

Trophozoite

Several trophozoites are usually found in the gut lumen, gliding freely there. The smallest individuals seen was 25 μ in length. Measurements in microns of a small one are: Total length 37, length of protomerite 12, deutomerite 25, width of protomerite 11, deutomerite 13. Ratio of LP : TL = 1 : 3.1, WP : WD = 1 : 1.2. The epimerie is not discernible in this stage, but the small lens-shaped disc at the apex of protomerite is observed as clear area. The protomerite is subglobular, well rounded at the anterior end and is almost as wide as its length. There is a fairly deep constriction at the septum. The deutomerite is ellipsoidal, widest at a short distance below the septum. From here it tapers to the posterior portion and it slightly widens again in globular at the posterior extremity.

The protoplasm of the trophozoite is not dense, light coloured and is almost devoid of it in the protomerite. The nucleus is visible in the living specimen as somewhat more transparent an area. It is spherical in shape and contains one deeply staining karyosome.

Systematic position

Though the cysts and spores have not been observed, this gregarine may be assigned to the genus *Cephaloidophora* on account of its shape of the anterior portion of the protomerite and the sporonts are biassociative, parasitic to the intestine of Crustacea. Among the members of this genus, this species closely resembles in many respects to *C. olivia* (WATSON) KAMM 1922 as follows: the body is ellipsoidal; length of the body varies 60 μ to 120 μ, width 25 μ to 50 μ; the deutomerite is but a little wider than the protomerite (1 : 1.1—1.3); the nucleus is spherical with one large karyosome. But this species differs from the latter in the following points: the ratio of LP : TL is in this species 1 : 4.0 and in the latter 1 : 3.0; the ratio of WP : WD in satellite is 1 : 1.1 in this species and 1 : 1.3 in the latter; the disc at anterior end of the protomerite is coloured orange in *C. olivia* and it is merely transparent in this point; the anterior disc of this species does not rise so conspicuously as that of the American species in young stage.

13. *Cephaloidophora pagri* n. sp.

(Figures: 77, 78, 80)

Diagnosis: Sporonts biassociative elongate cylindrical. Length of asso-

ciation 285μ. Maximum length of sporonts 150μ, width 35μ. Ratio, $\frac{LP:TL}{lp:tl}=\frac{1:6.0}{1:7.0}$, $\frac{WP:WD}{wp:wd}=\frac{1:1.1}{1:1.1}$. Protomerite hemispherical, rounded at apex, with lens-shaped disc there. Deutomerite cylindrical, widest slightly below shoulder, flattened or concaved at posterior end. Nucleus spherical with one karyosome. Endocyte of deutomerite is much denser than that of protomerite.

Host: *Eupagrus samuelis* STIMPSON, *Pagurus* sp. Decapoda, Crustacea.

Habitat: Intestine.

Locality: Hikari, Naruto (Yamaguchi Prefecture)

Thirty-five hermitcrabs were examined and eight yielded parasites. The infection of this gregarine was not heavy, twenty to fifty parasites being found in each of them at Hikari, in May, 1953.

Sporont

The sporonts are biassociative as adults. Pairs are the most common type, and generally, but not always, the posterior member of this syzygy is longer than the anterior one. Although the anterior member is frequently more swollen than the posterior one. Sometimes, an abnormal syzygy is formed by two individuals each attaching themselves to the posterior end of the primite, thus producing what appears bifurcated tail. The largest association measured 285μ in length while sporonts averaged 110μ in length and 25μ in width.

(Primite) The primite is elongate cylindrical. The ratio of LP : TL=1 : 4.2—6.6, WP : WD=1 : 1.0—1.2. The protomerite is hemispherical, well rounded in front, widest along the center. In some specimens the protomerite is roughly pentagonal in outline, widening gradually from the base and attaining its greatest width at the beginning of the posterior two-thirds of the protomerite. From here the protomerite contracts rapidly, ending in a rounded anterior end. A lens shaped disc, 10—12μ in width and 6—8μ in length is embedded in the center of the anterior end. About one third of the disc usually protrudes above the surface and the remaining parts can be seen inside the protomerite. There is a slight constriction at the septum. The deutomerite is elongate cylindrical, broadening rapidly backwards from the septum and being widest at short distance below the shoulder. From thence it tapers gradually to the posterior end, terminating in a broadly rounded or in a terminated extremity.

(Satellite) The protomerite of the satellite fits into the deutomerite of the primite, and small identation is discernible at the center of the interlocking plane. The ratio of LP : TL=1 : 5.5—8.1, WP : WD=1 : 1.0—1.1 The protomerite is of practically the same width as that of the primite, but is slightly flattened at top and bottom. It is widest in the middle. There is a slight or no constriction at the septum. The deutomerite is elongate

cylindrical, of even width throughout and generally a little narrower than that of the primite. The deutomerite terminates in a truncated or in a concaved posterior extremity.

The protomerite is lighter than the deutomerite and is nearly transparent, containing a few large irregular deeply staining granules clustered in the lower region of the protomerite, especially near the septum. The anterior portion and both-side regions of the protomerite are almost devoid endoplasm. The deutomerite is denser, being dark brown in transmitted light. The granules of the deutomerite are not homogeneous, the smaller being interpersed with the larger. The epicyte is rather thin, transparent and of even width throughout except at the anterior end of the protomerite. Where the surface is thickened in the region of the disc and in some speciemens this region has the appearance of a band surrounding the disc.

The nucleus is visible in vivo; it is spherical and in diameter about half the width of the body. It lies generally a short distance above the middle in the primite and on the contrary below the middle in the satellite. The position of the nucleus, however, is variable. The nucleus measures 10—18μ in diameter, containing one spherical karyosome. The karyosome averages 3μ in diameter and stains deeply with DELAFIELD's haematoxylin.

The animal is capable of movements both of bending and of gliding progression.

A table of measurements follows, in which dimensions are given in microns:

Total length association	245	255	251	243	151
Primite :					
Length sporont	115	130	113	105	63
Length protomerite	20	21	17	17	15
Length deutomerite	95	109	96	88	48
Width protomerite	25	27	25	25	20
Width deutomerite	27	31	30	29	19
Ratio of LP : TL	1 : 5.8	1 : 6.2	1 : 6.6	1 : 6.2	1 : 4.2
Ratio of WP : WD	1 : 1.1	1 : 1.1	1 : 1.2	1 : 1.2	1 : 1.0
Nucleus diameter	17	16	16	13	7
Satellite :					
Length sporont	130	125	138	138	88
Length protomerite	20	16	17	20	16
Length deutomerite	110	109	121	118	72
Width protomerite	27	23	23	23	20
Width deutomerite	29	25	25	25	19
Ratio of LP : TL	1 : 6.5	1 : 7.8	1 : 8.1	1 : 6.9	1 : 1.0
Ratio of WP : WD	1 : 1.1	1 : 1.1	1 : 1.1	1 : 1.1	1 : 1.0
Nucleus diameter	18	13	16	10	8

Trophozoite

In this species, the sporonts unite fairly early in development, so that most of individuals dwelling in the lumen are associated in twos. Solitary trophozoites are also found in the gut lumen. Measurements in microns of a trophozoite are: total length 50, length protomerite 12, length deutomerite 38, width protomerite 15, width deutomerite 16. Ratio of LP : TL=1 : 4.2. Ratio of WP : WD=1 : 1.1. Diameter of nucleus 6. The outline of the body is usually elongate cylindrical. The protomerite is hemispherical, widest at the base and well rounded anteriorly. The deutomerite is cylindrical, of same width throughout or slightly constricted in the middle, and terminates in a broadly rounded extremity. The protomerite is transparent, containing a large vacuole in the central portion. The deutomerite is light brown in colour and is much paler than that of the adult.

Systematic position

This species belongs to the genus *Cephaloidophora* by its characters of the sporonts and especially of the anterior end of the protomerite. One species of this genus has been reported from the genus *Eupagrus* in France and it is named as *C. ocellata* (LEGER & DUBOSCQ) KAMM 1922. This Japanese form resembles the French form in some points, but differs from the latter in these points, viz.: the size of the latter is smaller than the former; the primite is always smaller than satellite in this species; two large corpuscles resembling eyes are never found in both primite and satellite of this species as the latter; Nucleus is spherical in the former and it is ovoidal to rectangualr in the latter.

14. *Cepholoidophora late* n. sp.

(Figures : 43—47)

Diagnosis: Sporonts biassociative, obese. The couple attaining a total length of 410μ. Maximum length of sporont 200μ, maximum width 110μ. Ratio $\frac{LP : TL}{lp : tl}=\frac{1 : 5.0}{1 : 5.0}$, $\frac{WP : WD}{wp : wd}=\frac{1 : 1.5}{1 : 1.5}$. Protomerite hemispherical, well rounded at anterior end. shallow constriction at septum. Deutomerite ovoidal widest through middle, rounded broadly at posterior end. Endocyte dark brown with one large vacuole in protomerite. Nucleus spherical with one karyosome. Cyst spherical, 100—150μ in diameter. Spores spherical 5μ in diameter.

Host : *Penaeopsis akayebi* (RATHBUN) Decapoda, Crustacea.

Habitat : Intestine.

Locality : Ōbatake (Yamaguchi Prefecture).

This parasite is present as a secondary one. It never occurs in large number but is more generally found than the former species in the same host. It is easily separated from the two other species in both content and shape,

especially of the protomerite.

Sporont

The sporonts are biassociative and obese. The maximum recorded length for an association was 410 μ. The largest sporont seen was 220 μ long and 110 μ wide.

Primite : The average ratio of LP : TL = 1 : 5.0, WP : WD = 1 : 1.5. The body is ovoidal in shape. The protomerite is hemispherical, well rounded at the anterior end; it is about 1.5 times as wide as high, and widest at the base. The constriction at the septum is shallow but is conspicuous. The deutomerite is ovoidal, broadening gradually backwards from the septum and attaining its greatest width in the middle, or at the beginning of the posterior two thirds of the body From thence the deutomerite tapers gradually to the posterior portion, terminating in a well rounded and not flattened posterior end.

Satellite : The ratio of the various parts of the body is not essentially different from that of the primite. The protomerite is hemispherical and looks like that of the primite. The deutomerite is ovoidal, widening rapidly from the septum to the shoulder and is widest at about one third of its length below the septum.

The interlocking device between primite and satellite is not well developed and individuals of an association are easily detatched by slightest pressure.

In the mature sporont, the endoplasm is dark brown by transmitted light. It is finely granular, homogeneous and dense. There is no difference in the colour or granules of endoplasm of the protomerite and deutomerite, but one large vacuole is present in the protomerite. The epicyte is rather thick, transparent, of even width throughout. A large disc, 25—30 μ in width and 8—10 μ in length is embedded in the center of the anterior end of the protomerite.

The nucleus is spherical, generally visible in the adults and is measured 20 μ in average diameter. It contains one large karyosome which is visible without staining.

The sporonts are fairly actively motile, especially so just before the cyst formation, exhibiting both gliding and twisting movements.

Cyst and spore

The cysts are spherical, measureing 100—150 μ in diameter, which are occasionally found in the faeces. The newly-formed cysts are very dark in colour and the nuclei of the sporonts are only just discernible in the living stage. The dehiscence is simply exhibted by the rupture of the cyst membrane. The ripe spores are spherical in shape and measure 5 μ in diameter.

Trophozoite

The earliest stage of this parasite was a cephalont, mesured 50μ in length and 30μ in width. The body is differentiated into segments : protomerite and deutomerite. There is a small projection on the apex of the anterior disc of the protomerite. It is considered to be a vestigial epimerite. This organella is not retained but absorbed in time in the well developed individuals.

Measurements of some cephalonts and sporonts are as follows : all dimensions are given in microns :

Cephalont :

Total length	100	100	120
Length protomerite	22	25	28
Length deutomerite	78	85	92
Width protomerite	32	35	38
Width deutomerite	40	42	62
Ratio of LP : TL	1 : 4.5	1 : 4.4	1 : 4.3
Ratio of WP : WD	1 : 1.3	1 : 1.2	1 : 1.6

Sporont

			pri. 1	pri. 2	sat. 1	sat. 2
Total length	178	200	210	185	200	160
Length protomerite	35	40	45	35	40	31
Length deutomerite	143	160	165	150	160	129
Width protomerite	50	58	70	60	75	50
Width deutomerite	73	102	100	90	110	70
Ratio of LP : TL	1 : 5.1	1 : 5.0	1 : 4.7	1 : 5.3	1 : 5.0	1 : 5.2
Ratio of WP : WD	1 : 1.5	1 : 1.8	1 : 1.4	1 : 1.5	1 : 1.5	1 : 1.4

Systematic position.

This species bears some resemblance to *C. nigrofusca* (WATSON) KAMM and *C. punctata* n. sp. approximate in size and ratio of various parts of the body, but in *C. nigrofusca* the sporonts are solitary and in this species they are biassociative. *C. lata* n. sp. differs from *C. punctata* n. sp. in the following points : average ratio of WP : WD is 1 : 1.5 in the former and 1 : 1.2 in the latter; diameter of cyst is larger in the former than in the latter, but diameter of spores is, on the contrary, larger in the latter than in the former; a large vacuole usually situates in the protomerite of the former species, whereas there is none in that of the latter, except several chromidial bodies scattering through the body.

The form of this species is different from any member of this genus *Cephaloidophora* in having a large vacuole in the protomerite of both primite and

satellite, so I prefer describing it as a new species, *C. lata* n. sp..

15. *Cephaloidophora akayebi* n. sp.
(Figure : 42)

Diagnosis : Sporonts biassociative, elongate cylindrical. Maximum length association 320 μ. Maximum length sporont 165 μ, width 43 μ. Protomerite subglobular, well rounded at apex, widest through middle. Deutomerite elongate cylindrical, well rounded at posterior end. Nucleus spherical 15 μ in diameter, with one large karyosome. Cyst and spores not known.

Host : *Penaeopsis akayebi* (RATHBUN).

Habitat : Intestine.

Locality : Hikari, Naruto (Yamaguchi Prefecture)

Sporont

The sporonts are biassociative as adults. The longest association ever measured is 320 μ. The sporonts are elongate cylindrical; the maximum length recorded is 165 μ and the maximum width 43 μ.

(Primite) The average ratio of LP : TL = 1 : 4.8, WP : WD = 1 : 0.9. The protomerite is subglobular in shape. It is usually a little wider than is long, well rounded at the anterior end and dilated in the middle. There is a slight constriction at the septum. The deutomerite is elongate cylindrical, of the same width throughout and very slightly narrower than the protomerite. It narrows rapidly at the posterior end, ending in a well rounded extremity.

(Satellite) The average ratio of LP : TL = 1 : 5.7, WP : WD = 1 : 1.1. The interlocking device between the sporonts is weakly developed and the individuals often barely touching are easily detached by slightest pressure. The protomerite is often not all flattened but is comparatively a little shorter than that of the primite and approximately of the same shape. It is as wide as the deutomerite or slightly narrower than it. The constriction at the septum is not deep. The deutomerite is elongate cylindrical and is quite alike that of the primite, but it is always wider than the protomerite. It terminates in a well rounded posterior extremity.

The mature sporont of this species appears light brown by transmitted light. There is no difference in colour or texture of the endoplasm of the protomerite and deutomerite, and both contain homogeneous and fine granules. The epicyte is rather thin throughout, except the anterior end of the protomerite. At this portion it is thickened, giving the appearance of a lens-shaped disc.

The nucleus is just visible in the living specimen. It is spherical in shape, measuring 15 μ in averaged diameter, and is almost always situated in

the middle : its position, however, is variable. The nucleus contains one large spherical karyosome within.

A table of measurements follows in which all dimensions are given in microns :

Length association	264	288	250	255	257	155
Primite :						
Length sporont	152	148	120	120	112	95
Length protomerite	30	28	28	25	25	20
Length deutomerite	122	120	92	95	87	75
Width protomerite	35	34	30	32	30	25
Width deutomerite	32	32	28	27	31	20
Ratio of LP : TL	1 : 5.1	1 : 5.3	1 : 4.3	1 : 4.8	1 : 4.5	1 : 4.8
Ratio of WP : WD	1 : 0.9	1 : 0.9	1 : 0.9	1 : 0.8	1 : 1.0	1 : 0.8
Satellite :						
Length sporont	112	140	130	135	145	60
Length protomerite	25	23	24	20	20	15
Length deutomerite	87	117	106	115	125	45
Width protomerite	34	30	25	28	22	18
Width deutomerite	36	32	30	29	27	20
Ratio of LP : TL	1 : 4.5	1 : 6.1	1 : 5.4	1 : 6.8	1 : 7.3	1 : 4.0
Ratio of WP : WD	1 : 1.1	1 : 1.1	1 : 1.2	1 : 1.0	1 : 1.2	1 : 1.1

Systematic position

Among the members of the genus *Cephaloidophora*, this species is similar in general outline to *C. olivia* (WATSON) KAMM 1916 and *C. ampelisca* (NOWLIN & SMITH) KAMM 1917 but differs from the others in size and ratio of various parts of the body.

This species is easily separated from *C. ocellata* (LEGER & DUBCSCQ) KAMM by the shape of body, characters of the protomerite and ratio of protomerite length to total sporont length. This species resembles *C. fossor* (LEGER & DUBOSCQ) TREGOUBOFF in size of the body and in ratio of protomerite length to total length but it differs from the latter in the ratio of protomerite width to deutomerite width and in having no trace of pore at the anterior end of the protomerite.

Genus *Carcinoecetes* BALL 1937

Sporonts associated in twos or more : syzygy occuring early. Intracellular development short. Rudimentary epimerite. Cyst without sporeducts, hatching by simple rupture. Sporocysts not in chains, but round or ovoidal. Monogenetic. Usually found in digestive tracts of Crustacea.

16. *Carcinoecetes ozakii* n. sp.

(Figures : 48–56)

Diagnosis : Sporonts elongate cylindrical frequently associated in groups of more than two up to five. Average size of solitary sporont 220 $\mu \times 35 \mu$. Protomerite of primite hemispherical, averages 1/12 total length of sporont, protomerite of satellite quadrilateral, frequently flattened. Epimerite rudimentary, hyaline knob 4 μ in diameter. Cyst spherical to ellipsoidal, measuring 120–180 μ in diameter. Dehiscence by simple rupture. Spores spherical 8 μ in diameter.

Host : *Penaeopsis akayebi* (RATHBUN) Decapoda, Crustacea.

Habitat : Intestine.

Locality : Naruto, Hikari (Yamaguchi Prefecture).

This parasite seems to be present as a third one. It never occurs in large numbers but is generally found in the same host as *Cephaloidophora akayebi* n. sp. and *Cephaloidophora lata* n. sp.. During the summer of 1952, I found this species comparatively more frequently than the other two and out of 120 hosts proved 85 individuals to be parasitized by this species at Ōbatake.

Sporont

The sporonts unite fairly early in development. Pairs are the most common type, although, associations of more than two are found in some examples. The greatest number of individuals seen in a single chain was five. Usually, but not always, the posterior member of a multiple associations is the longest. In some specimens two or three individuals attach themselves to the end of a primite, forming a bi- or trifurcated tail,

The average length of a full-grown pair is 450 μ; the primite measuring 200 μ; the satellite 250 μ. The longest association seen was 800 μ in length and the smallest only 70 μ.

(Primite) The ratio of LP : TL = 1 : 10–12, WP : WD = 1 : 1.4–1.3. The protomerite is hemispherical, slightly convex against the deutomerite and well rounded at the anterior end. It is about two times as wide as its height and widest in the middle. There is a slight constriction at the septum. The deutomerite is elongate cylindrical and of almost even width thoughout and only a little wider than the protomerite. The widest portion of the deutomerite is a short distance below the septum or about the middle and is truncated at the posterior extremity.

(Satellite) The satellite is generally longer than the primite but is never as wide as the latter. The ratio of LP : TL = 1 : 11–15, WP : WD = 1 : 1.0 –0.9. The protomerite is greatly surpassed and flattened. It is often quadrilateral with parallel edge, and is a little wider than it is long. A little

shallow constriction is present at the septum or none at all. The deutomerite is slender cylindrical and widest at the shoulder or a little behind the septum. The body gradually tapers from the region of the greatest width, ending in a blunt, well rounded posterior extremity. The interlocking device between primite and satellite is deep and well developed.

The endocyte is brown in colour by transmitted light. The protomerite contains a four large spherical granules which are deeply stained with haematoxylin and mainly clustered near the septum. There is a small lens-shaped transparent disc situated at the anterior end of the protomerite. The region immediately below this disc is also quite or nearly transparent. The deutomerite is more or less dense and opaque, containing fine granules which stain with neutral red. In some specimens the deutomerite contains somewhat larger granules scattered evenly in its endocyte. The epicyte is rather thick, transparent and of even width throughout except at the anterior end of the protomerite of primite.

The nucleus is spherical or ellipsoidal in shape and $22\mu \times 18\mu$ in average size. It contains one karyosome within. The position of the nucleus in the nucleus is changeable but it is usually situated in the middle or slightly below the middle, sometimes at the extreme posterior end, but rarely at the anterior extremity.

A table or measurements in which dimension are given in microns, follows :

Length association	540	480	320	290	310
Primite :					
Length sporont	210	200	140	120	115
Length protomerite	18	18	14	12	12
Length deutomerite	192	182	126	108	103
Width protomerite	30	28	25	20	18
Width deutomerite	40	38	36	29	26
Ratio of LP : TL	1 : 11.7	1 : 11.1	1 : 10.0	1 : 10.0	1 : 9.6
Ratio of WP : WD	1 : 1.3	1 : 1.4	1 : 1.4	1 : 1.5	1 : 1.4
Satellite :					
Length sporont	330	280	180	170	195
Length protomerite	30	23	14	14	13
Length deutomerite	300	257	166	156	182
Width protomerite	34	34	22	22	22
Width deutomerite	35	34	23	20	22
Ratio of LP : TL	1 : 11.0	1 : 12.2	1 : 12.9	1 : 12.1	1 : 15.0
Ratio of WP : WD	1 : 1.0	1 : 1.0	1 : 1.0	1 : 0.9	1 : 1.0

Measurements of associations of more than two sporonts are shown below:

	(1)	(2)	(3)	(4)	(5)
Primite	245×36	133×30	125×34	120×35	125×35
Satellite 1	285×32	137×28	127×32	135×30	129×32
Satellite 2	162×22	164×24	150×23	157×25	148×30
Satellite 3				167×22	156×26
Satellite 4					172×23

Trophozoite

The earliest stages of this species which were observed in smears were the young cephalonts. These cephalonts are provided with a simple spherical epimerite. One of these cephalonts, measuring 30 μ in length differentiates the body segments; epimerite, protomerite and deutomerite. The epimerite of this specimen measures 4 μ in diameter. The epimerite seems to be very susceptible to environmental changes and generally falls off when the parasite is placed in direct contact with sea water.

Cyst and spore

When the spronts are entirely mature; the body being well filled with protoplasmic granules and fairly opaque, they become sluggish in motion and tend to revolve. Besides the numerous straight chains of sporonts, I could find associations of two or more individuals in which the chain was curved up. The members of an association wrap themselves with each other to form a sphere, projecting and contracting the bodies so as to leave no unfilled spaces. The mass continues its slow rotation for one hour and half. In the early stage of the cyst formation there is no trace of a cyst wall, but a thin gelatinous envelope is secrated from those bodies after their ceasless rotation.

The cysts are spherical, sometimes slightly ellipsoidal and measure between 120 μ and 180 μ in diameter. The outer gelatinous envelope is transparant and measures 5—6 μ in thickness. In mature cysts, spores can be seen through the cyst wall. The cysts are dehisced by simple rupture. The spore are spherical, measuring 8 μ in diameter. It contains eight sporozoites and a spherical residual body situated in its center.

Systematic position

The genus in which I have placed the gregarine of this paper was created by BALL in 1937 for *C. conformis* (DIESING) BALL which had been considered to be a member of genus *Cephaloidophora*. The genus *Carcinoecetes* contains up to the present only two species, *C. conformis* and *C. hesperus* BALL.

This species resembles in many respects *C. hesperus*; for instance, the body is elongate cylindrical, sporonts associate in twos or more in numbers,

protomerite of satellite is suppressed, however, there are many differences between them. The following table indicates the chief different points.

	C. hesperus	*C. ozakii*
Average length of full grown pair	510 μ	450 μ
Average size of primite	170 $\mu \times 45\mu$	200 $\mu \times 35\mu$
Average size of satellite	340 $\mu \times 48\mu$	250 $\mu \times 30\mu$
Numbers of sporonts in an association	2—6	2—5
Average ratio of LP : TL	1 : 7	1 : 12
Size of cyst	140 $\mu \times 123\mu$	160 $\mu \times 130\mu$
Spore	round to oval 7.7 $\mu \times 8.6\mu$	spherical 8 μ in diameter
Epimerite	rudimental indistinctly marked off.	rudimentary hyaline knob 4 μ in diameter.
Protomerite of satellite	suppressed, flattened third or more posterior satellite have non.	suppressed, flattened more posterior satellite than second have protomerite

SETNA & BHATIA (1934) have reported two different species of gregarine from Indian prawns, which belong to the genera *Hirmocystis* and *Protomagalhaensia* respectively. These two species shall be transfered to the genus Carcinoecetes. This species resembles closely to these Indian forms, differing only from the two Indian species in size and ratio of body and in other characters of sporonts.

17, *Carcinoecetes japonicus* n. sp.

(Figures : 57—59)

Diagnosis : Sporonts associative from 2 to 4 individuals, elongate cylindrical. Maximum length association 1700 μ. Satellite longer than primite, satellite with no protomerite. Ratio in primite LP : TL=1 : 12, WP : WD=1 : 1.3. Protomerite hemispherical, with clear crescentic disc at apex. Deutmerite elongate cylindrical, widest through middle. Nucleus ellipsoidal, 70 $\mu \times 30\mu$. One large karyosome. Cyst spherical 160—300 μ in diameter. Spores spherical.

Host : *Penaeus japonicus* (BATE). Decapoda, Crustacea.

Habitat : Intestine.

Locality : Naruto, Hikari (Yamaguchi Prefecture)

Sporont

The sporonts are generally biassociative but often associate in groups of more than two, up to 4. The average length of a full-grown pair is 1mm and the width is 50μ; the primite measuring 350$\mu\times$50μ; the satellite 650$\mu\times$50. The smallest syzygy seen was 120μ in length, the longest 1700μ. Syzygies may be of two, three, or four individuals arranged linealy, or of two or three sporonts attached laterally to the posterior end of the primite. The satellite is usually longer than the primite and the second satellite longer than the first. The septum in the satellite is never present.

The ratio of various parts of the body in primite is as follows : LP : TL = 1 : 11.3—12.9, WP : WD = 1 : 1.2—1.3

The protomerite of the primite is roughly hemispherical, about 1.5 times as wide as it is high, and well rounded at the anterior end. It is widest at the base. There is a clear hollow crescentic area at the apex of the protomerite. The anterior edge of this area is concaved with a small pore. The constriction at the septum is not deep but is conspicuous. The deutomerite is elongate cylindrical, very slightly swollen in the middle, but is almost of even width throughout, and a little wider than the protomerite. It terminates in a truncated posterior end.

The interlocking device between primite and satellite is well developed and they are much intimately fused with each other. The satellite, having no protomerite is elongate cylindrical in shape, broadening rapidly backwards from the anterior end and attaining a maximum width at the shoulder which is the same as that of the primite. From thence the satellite tapers gradually to the posterior portion, ending in a very slender, bluntly pointed posterior extremity.

The protoplasm is dense in the deutomerite, being brown in transmitted light; it is nearly as dense in the lower half of the protomerite, but the upper portion of the latter is somewhat lighter in colour, showing the fine longitudinal striations on its surface. The epicyte is rather thin, transparent and of even width throughout except at the anterior end of the protomerite, where it becomes considerably thicker.

Measurements of a few association with all dimensions expressd in microns are as follows :

Total length of association	1390	940	945	1180	1190
Primite :					
Length sporont	360	340	370	400	440
Length protomerite	31	30	30	32	34
Length deutomerite	329	310	340	368	406

Width protomerite	45	40	45	48	45
Width deutomerite	60	50	52	60	60
Ratio of LP : TL	1 : 11.6	1 : 11.3	1 : 12.3	1 : 12.5	1 : 12.9
Ratio of WP : WD	1 : 1.3	1 : 1.3	1 : 1.2	1 : 1.3	1 : 1.3
Satellite : I					
Length sporont	430	600	575	780	750
Width sporont	48	50	50	50	52
Satellite : II					
Length sporont	590				
Width sporont	46				

The nucleus of sporonts is an elongate ellipsoid, generally placed parallel to the body axis. In large specimens, it measures about $70\mu \times 30\mu$. It contains one large spherical karyosome which stains deeply with haematoxylin. The nucleus is visible in vivo in the large and dense sporonts as a somewhat clear area.

Trophozoite

The smallest trophozoite found in smears is an ellipsoidal one which measures 60μ in length and 15μ in width. It is much less dense than the sporont. The nucleus of this stage is spherical in outline, but it becomes ellipsoidal as the body grows larger. The trophozoites have an epimerite at the anterior end of the protomerite. The epimerite is a small hyaline papilla which is to be easily shed off in sea water.

Cyst and spore

The cysts are found in the posterior portion of the intestine. They vary in diameter from 160μ to 300μ and the outer gelatinous envelope measures $4-5\mu$ in thickness. The cysts are dehisced by a simple rupture. The spore with some small particles around it, is spherical in shape and is extruded from the cyst not in chain.

Systematic portion

This species belongs to the genus *Carcinoecetes* since its features are assigned to those of this genus : sporonts associated in twos or more; syzygy occurring early. Rudimentary epimerite. Cyst dehiscing by simple rupture. Spores round, not in chain. Among the members of the genus *Carcinoecetes*, this species bears some resemblance to *C. hesperus* BALL and *C. ozakii* n. sp. in the shape of the body, but it differs from the others in the following points : average length of full grown pair is much larger than the latters; satellite size of sporonts is also larger; satellite has no protomerite;

In shape and other characters, this species closely resembles to the gregarine which was found by SETNA & BHATIA (1934) from a prawn, *Parapeneopsis sculptilis* (HELLER). They made that Indian form temporarily belong to the genus *Protomagalhaensia* and named *P. attenuate*. My species may be easily separated from the Indian species by the considerable difference in size and by the different character of the associated form.

Family STENOPHORIDAE LEGER & DUBOSCQ 1904

Genus Stenophora LABBE, 1899.

18. *Stenophora fusiuli* HOSHIDE, 1952.
(Figures : 63—65)

Diagnosis : Sporonts solitary, polymorphic, elongate cylindrical to ovoidal. (Elongate type); Maximum length 470μ, maximum width 70μ. Average ratio of LP : TL=1 : 11, WP : WD=1 : 1.4. Protomerite hemispherical with a pore at apex. Deutomerite cylindrical, bluntly pointed posteriorly. Nucleus spherical, 25μ in diameter, with one karyosome. (Ovoidal type); Average length 250μ, width 90μ. Ratio of LP : TL=1 : 9,5 WP : WD=1 : 2.3. Cyst spherical, 90—150μ in diameter, spores spindle shape 9μ ×4μ.

Host : *Fusiulus* sp. Juliformia, Dipropoda.

Habitat : Intestine.

Locality : Ōbatake (Yamaguchi Prefecture)

19. *Stenophora suhoensis* HOSHIDE, 1952.
(Figures : 66, 67)

Diagnosis : Sporonts solitary, ovoidal to ellipsoidal. Maximum length 250μ, width 70μ. Ratio of LP : TL=1 : 7.9, WP : WD=1 : 2.1. Protomerite hemispherical, widest just above the base, with an apparent pore at apex. Deutomerite elongate ovoidal. Nucleus spherical 20μ in diameter, with one karyosome. Cysts spherical 70—150μ in diameter, spores fusiform to ovoidal 7μ ×4μ.

Host : *Fusiulus simodanus* TAKAKUWA Juliformia, Diplopoda.

Habitat : Intestine.

Locality : Hikari (Yamaguchi Prefecture)

20. *Stenophora murozumiensis* HOSHIDE, 1952.
(Figures : 68, 69)

Diagnosis : Sporonts solitary, elongate ovoidal to cylindrical. (Elongate type); Maximum length 100μ, width 28μ. (Contracted type); Maximum length

71μ, width 36μ. Ratio of LP : TL = 1 : 6, WP : WD = 1 : 1.5. Protomerite hemispherical, with a pore at apex. Deutomerite widest in posterior three quarters, bluntly pointed at posterior end. Nucleus spherical, 13μ in diameter, with one karyosome. Cysts spherical 70μ in diameter, spores spindrical, 9μ×5μ.

Host : *Fusiulus* sp., Juliformis, Diplopoda.

Habitat : Intestine.

Locality : Murozumi (Yamaguchi prefecture).

21. *Stenophora orthomorphae* HOSHIDE, 1952.

(Figures : 70, 71)

Diagnosis : Soronts solitary, elongate cylindrical. Maximum length 320μ, width 61μ. Ratio of LP : TL=1 : 9.6, WP : WD=1 : 1.9. Protomerite hemispherical, slightly wider than long, widest just above the septum, with a small papilla and pore at apex. Deutomerite elongate cylindrical, widest in various parts of deutomerite. Nucleus spherical, 20μ in diameter, with one karyosome. Cysts spherical 80—90μ in diameter. Spores not known.

Host : *Orthomorpha* sp. Juliformia, Diplopoba.

Habitat : Intestine.

Locality : Ōbatake (Yamaguchi Prefecture)

22. *Stenophora flexuosa* n. sp.

(Figures : 81—85)

Diagnosis : Sporonts solitary, elongate cylindrical, curved. Maximum length 450μ, width 45μ. Ratio of LP : TL=1 : 20—30, WP : WD=1 : 1.6—2.0. Protomerite hemispherical, with an indentation at apex, fine canal in its center. Deutomerite long, divided into two parts by constriction, swelled at anterior half and narrowed at posterior, rounded at posterior end. Nucleus ovoidal to ellipsoidal, 18μ×13μ, with one spherical karyosome. Intracellular development. Cyst and spores not known.

Host : *Orthomorpha* sp. Juliformia, Diplopoda.

Habitat : Intestine.

Locality : Kojiro (Yamaguchi Prefecture)

This gregarine is a strange one which is similar in the general outline to *Stenophora nematoides* LEGER and DUBOSCQ and *St. diplocorpa* WATSON. The host diplopod, *Orthomorpha* sp., was collected beneath stones or rubbishes in an oragne orchard, during October, 1952. Out of 72 diplopods examined 14 individuals are found infected with this species and at the same time almost all members are also found parasitized with another species of *Stenophora* on the same occasion.

Sporonts.

Form and Size: The sporonts are solitary. They are very elongate cylindrical in shape and are always curved on one side crescentically. The protomerite is always slightly wider than long in adult but is as wide as long in younger stage. The total length of the body ranges from one-thirtieth to one-twentieth the total length of the body. The protomerite is almost hemispherical but its anterior half is rather broadly conical, having an indentation at its anterior end. The pore is conspicuous and here a fine canal runs deeply into the center of the protomerite. A fibrillar bundle connected with the epimerite is recognized in it. Its widest part is just above the base and the constriction is shallow but conspicuous at the septum.

The deutomerite is a cylindrical nod incompletely divided into two parts by a conspicuous but shallow constriction at about the middle. The anterior half increases gradually in its width from the septum up to the beginning of the anterior one-fourth or one-third of the deutomerite, then it begins gradually to be narrower again. The posterior half is practically of the same width throughout but in the middle coustriction the body gains its width gradually and slightly swollen at about the posterior one-third of the deutomerite. The maximum width of the posterior half is less than that of the anterior half. The deutomerite generally constricts slightly but conspicuously near the posterior end where it terminates in a bluntly rounded extremity.

The maximum length of sporonts tested was 450μ and the maximum width 45μ.

Measurement: The dimensions of the adult sporonts in microns are as follows.

Total length	420	370	330	296	264	263	256
Length of protomerite	14	14	13	14	13	13	12
Length of deutomerite	406	356	317	282	251	250	244
Width of protomerite	21	18	20	20	22	20	21
Width of deutomerite	39	34	35	36	38	32	41
Ratio of LP : TL	1 : 30.0	1 : 26.4	1 : 25.4	1 : 21.1	1 : 20.3	1 : 20.2	1 : 21.3
Ratio of WP : WD	1 : 1.7	1 : 1.9	1 : 1.8	1 : 1.8	1 : 1.7	1 : 1.6	1 : 2.0
Size of nucleus	23×11	20×15	20×11	20×13	19×15	17×12	20×12

Ecto- and Endoplasm: The epicyte is rather thin but stout and measures 3μ in average thickness. But on the posterior side of the protomerite and the

anterior side of the deutomerite just behind the septum, the epicyte becomes considerably thicker, 6μ or 7μ in thickness. Longitudinal fine striations are discernible in the epicyte and a bundle of delicate fibrillae projected from the center of the protomerite reaches the pore at the apex.

The endocyte of the protomerite is less dense than that of the deutomerite, especially its peripheral part and anterior half are transparent or nearly so, containing very fine granules. There are a few large deeply staining granules in the posterior half of the protomerite. The deutomerite is brown in colour and contains numerous deeply stained fine granules a little more densely distribute in the anterior half than in the posterior.

Nucleus : The nuculeus of sporonts is visible in vivo, and is varied in shape from ovoidal to ellipsoidal. It measures 18μ by 13μ in average size, containing one large spherical karyosome visible without staining. The karyosome measures from 6μ to 7μ in diameter. It is no definite where the nucleus is situated. Sometimes it lies just anterior to the middle constriction, or otherwise posterior to that. The direction of the nucleus axis is also unfixed, for example one specimen is situates parallel and in others parpendicular or obliquely to the body axis.

Development : The sporozoite extricating itself from a spore, enters in the epitherial cell and carries on an intracellular life in it growth and development to become a trophozoite. The youngest trophozoite found in the cell was 15μ in length. It is ovoidal in shape and differentiated already into a protomerite and a deutomerite. The older trophozoites emerge from the cell and remain sticking by the epimerite to the wall of the intestine. This species seems to adhere to the host cell for a pretty long while and then sometimes a fairly large trophozoites with an epimerite are found clinging to the surface of the intestine. Finally the epimerite is lost and the gregarine comes to live freely in the lumen.

Trophozoite : The body of the younger trophozoite, measuring 50μ to 70μ in length, straight in shape but with age it gradually gets crooked in a crescentic form. For example, the character of a trophozoite, 160μ long, is as follows : The epimerite is rather spherical in shape, measuring 4μ by 3μ, and it is situated immediately on the anterior end of protomerite without a stalk. A deeply stained spherical body connected with the fibrillar bundle is seen in the center of the epimerite. Sometimes the epimerite persists even after it is out of use over and is seen in one case on a fairly large specimen. The protomerite is as same as that on the adult but that it is as wide as it is long. When the body is pulled with anything power, the protomerite is considerably extended especially at its anterior portion, inserting the epimerite into the gut cell.

The deutomerite is clearly divided into two parts by the shallow constriction is the middle as adult, and the two parts are almost the same in size and shape in this trophozoite stage. It is widest at the anterior one-fourth of the deutomerite and measures 18 μ in breadth, and the width of the posterior half is also measured same as its breadth. With age the anterior half increases in the width mainly, and on the other hand the posterior half attains its length and finally they present the adult form.

A table of measurement of some trophozoites, in which all dimensions are given in microns as follows.

Total length	160	145	140	110
Length protomerite	9	10	10	8
Length deutomerite	151	135	130	102
Width protomerite	9	10	10	8
Width deutomerite	18	15	14	12
Ratio of LP : TL	1 : 17.8	1 : 14.5	1 : 14.0	1 : 13.0
Ratio of WP : WD	1 : 2.0	1 : 1.5	1 : 1.4	1 : 1.5

Systematic position : Among the members of the genus *Stenophora* this species bears a fair resemblance to *St. diplocorpa* WATSON mainly in having a constriction through the middle of the deutomerite. The comparison between the two species is given of the features as follows :

	St. diplocorpa	*St. flexuosa* n. sp.
Body shape	cylindrical attenuate	cylindrical attenuate curved in outline.
Total length	297 μ —359 μ	450 μ max.
Total width	45 μ —57	32 μ —45 μ
LP : TL	1 : 16—25	1 : 21—30
WP : WD	1 : 2.2—3	1 : 1.6—2
Epimerite	persists long,	persists long
	large hyaline smooth knob,	spherical knob, hyalin but contains central mass.
	with short stalk	without stalk.
Shape protomerite	anterior half broadly conical	anterior half broadly conical
	blunt at apex	blunt at apex
	no indentation	with an indentation at apex. canal runs through its center
Shape deutomerite	separated into nearly equal two parts by a beep constriction,	separated into two parts not equal in adult but nearly equal in young stage
	terminates bluntly	terminates bluntly.

Nucleus	spherical	ovoidal to ellipsoidal
	situates just below the central constriction	situation varies from anterior to posterior region
	one large karyosome.	one large karyosome.

This species is also similar in general outline and in shape of nucleus to *St. mematoides* LEGER and DUBOSCQ. They differ in the following points: the protomerite is much longer than it is wide in *St. nematoides* and in *St. flexuosa* is as long as it is wide or a little wider than it is long; there is an indentation at the apex of the protomerite but it is comparatively shallow in *St. nematoides* and in *St. flexuosa* the indentation becomming a canal, running deeply into the middle of the protomerite; The ratio of width protomerite : width deutomerite is 1 : 2.5—3 in *St. nematojdes* and in *St. flexuosa*, it is 1 : 1.6—2.0; in the contents of the protomerite and in the character of movement. These two species are easily classified as a different species of the Genus *Stenophora*.

23. *Stenophora kojiroensis* n. sp.
(Figures 89—93)

Diagnosis : Sporonts solitary, gourd-shape, obese. Maximum length 200μ, width 70μ. Protomerite hemispherical, with an apparent pore at apex. Deutomerite slightly constricted through middle, bluntly rounded at posterior end. Nucleus from ovoidal to ellipsoidal, 15μ × 10μ, with one karyosome. Epimerite a small knod. Cyst and spores not known.

Host : *Orthomorpha* sp. Juliformia, Diplopoda.

Habitat : Intestine.

Locality : Kojiro (Yamaguchi Prefecture)

This species is another one found in the same host of *Stenophora flexuosa* HOSHIDE. The number of parasites found in one host is not very large but this species is more generally seen than in the latter. During October, 1953, 85% of seventy-twe diplopods examined contained a few of this gregarine.

Sporont.

Form and Size : The sporonts are solitary. They are generally gourd-like in shape and not curved to one side as the another species. The maximum length recorded is 200μ and the maximum width 70μ. The protomerite is hemispherical but the upper half is slightly conical, being blunt at the apex. Here there is an apparent pore in which a small spherical hyaline epimerite is usually situated in the young trophozoite stage. There is no canal here. The widest is just anterior to the septum. The length of the protomerite is about three fourths its width or one ninth to eleventh the total length. The const-

riction at the septum is conspicuous. The deutomerite is roughly elongate cylindrical, gradually widens from the septum towards the end of the anterior one-fifth of the deutomerite and it narrows twards its middle. There is generally a loose constriction through the middle and here it broadens again as it nears the beginning of the posterior tapering one-fourth of the deutomerite, the wide portion to the blunt posterior extremity. In some specimens the widest portion is at the former swelling region and in others at the posterior swelling one.

Ecto- and Endoplasm : The protomerite which is dense, contains many large granules except that the anterior small region immediately below the apex is almost transparent without granules. The deutomerite contents is finely granular, homogeneous and is denser than that of protomerite. The region near the posterior end, however, is rather transparent with a few finely granular endocyte. The body is pale brown in transmitted light. The epicyte is rather thick, measuring 3μ in thickness all over the surface, though, it becomes thicker near the middle constricted region of deutomerite than in other part. Fine longitudinal striations are seen on the surface of the deutomerite, especially at its anterior portion several well developed ridges are seen. In old specimens there is a small pore at the apex and in young ones a small button -shaped body, which is seems to be a degenerated epimerite, is often attached to the pore.

Nucleus : The nucleus is ovoidal to elongate ellipsoidal in shape. The situation of the nucleus is variable, being located at the middle in some specimen but in others near the posterior or the anterior region of the deutomerite. It is generally visible in vivo but its contents are hardly discernible in living stage. The stained preparations show an ellipsoidal nucleus with a single spherical karyosome measuring 4.5μ to 6μ in diameter and sometimes a few chromatic granules are discernible in it.

Measurements : A table of dimensions of a few sporonts all dimensions are expressed in microns;

Total length sporont	134	154	162	175	178	168
Length protomerite	17	17	15	18	21	20
Length deutomerite	117	137	147	157	157	148
Widtd protomerite	25	22	22	22	26	24
Width deutomerite	36	35	34	38	40	60
Ratio of LP : TL	1 : 7.9	1 : 9.1	1 : 10.8	1 : 9.7	1 : 8.5	1 : 8.4
Ratio of WP : WD	1 : 1.4	1 : 1.6	1 : 1.5	1 : 1.7	1 : 1.5	1 : 2.5
Nuclear diameter	15×7	17×8	14×8	15×10	16×10	16×9

Movement : Of the sporont is very tardy, however, it progresses forward

at the rate of average 60μ per minute. Beside this simple gliding movement a contorting movement is commonly observed, twisting suddenly to one side at the anterior portion of the deutomerite.

Cysts and spres are not found. With age the sporonts shorten their body length and swell to become violin-shaped in outline. These full-grown individuals contain numerous spherical large globules with crystalloides in both protomerite and deutomerite.

Systematic position :

Among the members of the genus *Stenophora*. this speciee resembles *S. robusta* ELLIS in the size and ratio of body parts, but it differs from the latter in the shape of body, which of the latter is short and thick and much wider than that of the former; in the shape of the nucleus, which of the latter is spherical and that of this species is ovoidal to ellipsoidal.

This species can be easily distinguished from *S. dauphinia* WATSON and *S. varians* LEGER & DUBORCQ by the shape of the body, which is slender cylindrical with no constriction through the middle in the others.

From *S. orthomorphae* HOSHIDE which is a parasite of Japanese diplopod, this species is separated in the size and shape of the body.

24. *Stenophora hagiensis* n. sp.

(Figures 86–88)

Diagnosis : Sporonts solitary, elongate cylindrical, curving on one side. Maximum length 470μ, width 55μ. Average length 400μ width 45μ. Ratio, LP : TL=1 : 15, WP : WD=1 : 1.6. Protomerite subglobular, wider than long. Deutomerite elongate cylindrical, curved on one side, widest at anterior quarter bluntly ending posteriorly. Nucleus ellipsoidal, 40μ×20μ, with one karyosome. Epimerite rudimentary, a conical knob with short broad stalk, persists long. Cyst and spores unknown.

Host : *Rhysodesmus* sp. Juliformia, Diplopoda.

Habitat : Intestine.

Locality : Hagi (Yamaguchi Prefecture)

Sporont

The sporonts are solitary. The body is very elongate cylindrical and always curves on one side. The protomerite is subglobular, dilated just above the base and tapering rather rapidly with a well rounded anterior end at the apex. The widest part is a little distance above the septum. The protomerite is slightly wider than long. There is a shallow but conspicuous constriction at the septum. The deutomerite is elongate cylindrical and is curved on one

side. It widens acutely from the septum to the shoulder and then widens very gradually to the posterior region. It is widest at the beginning of the anterior quarter of the deutomerite. The deutomerite at the widest region gradually becomes narrower, ending in a blunt extremity.

The epimerite is a rudimentary conical knob with a short stalk, broads at the base. In some specimen the epimerite is contracted and several folds are seen on the surface. It evidently persists long after the gregarine has developed and is observed usually on a large individual free in the gut lumen.

The largest sporont measured 470 μ in length and 55 μ in width while the sporonts averaged 400 μ in length and 45 μ in width. The ratio of LP : TL = 1 : 14.0—16.7, WP : WD = 1 : 1.1—1.7.

A table of the more important mesurements follows with dimensions expressed in microns :

Total length sporont	270	350	400	415	420	450
Length protomerite	19	22	24	25	30	27
Length deutomerite	252	328	376	390	390	423
Width protomerite	24	25	30	28	32	30
Width deutomerite	26	35	42	50	53	50
Ratio of LP : TL	1 : 15.0	1 : 15.9	1 : 16.7	1 : 16.6	1 : 14.0	1 : 16.7
Ratio of WP : WD	1 : 1.1	1 : 1.4	1 : 1.4	1 : 1.8	1 : 1.7	1 : 1.7

The protomerite is more or less transparent, containing but few large crystal grnules of protoplasm which cluster especially near the septum and stain deep with haematoxylin. There is an apparent canal through the ectocyte of the anterior end of the protomerite. The deutomerite is denser and opaque containing fine, homogeneous granules and is light brown in colour by transmitted light. The epicyte is rather thick, of even width throughout. Especially it is thick at the anterior portion of the protomerite and near the septum.

The nucleus is ellipsoidal, generally the long axis is laid parallel to the long axis of the body. In some specimens it lies obliquely to that of the body. The nucleus averages 40 μ × 20 μ in size, containing one spherical karyosome which measures 8 μ in diameter.

Two types of movement, gliding and contorting, were observed in this gregarine. Progression has been performed at the rates of 5—7 μ per second. A contortion of the anterior portion of the body is common and the region of the septum is very active. I have never observed the motion of nematoid type reported in *S. nematoides* LEGER & DUBOSCQ.

Trophozoite

The earliest stages of this gregarine observed in sections were the ovoidal

young trophozoites, measuring about 20--25μ ×10μ. The young parasites which lie embedded in the cells of the intestinal epithelium had not differentiated any segments of the body, epimerite, protomerite and deutomerite.

With ages the trophozoite grows and increases in body size, especially so in its length. When the parasite attains a length of 40μ, the septum between the protomerite and the deutomerite is formed. In smearing preparations still larger ones are found and all of them equipped with the unique epimerite at the anterior end of the protomerite. They break through the host cell and attach to the gut epithelium with this epimerite. One of them is measured as follows, dimensions expressed in microns : total length 60, length protomerite 16, length deutomerite 44, length epimerite 4, width protomerite 17, width deutomerite 25. Ratio of LP : TL=1 : 3.8, WP : WD=1 : 1.5. In this stage the body is ovoidal in shape and the nucleus is spherical measuring 8μ in diameter.

A fairly large cephalont, which is elongate cylindrical and straight in outline, is also measured : Total length 100, length protomerite 18, length deutomerite 82, with protomerite 17, width deutomerite 25, epimerite size 9×6, nuclear size 24×10. Ratio of LP : TL=1 : 5.6, WP : WD=1.5. The epimerite is usually dilated anteriorly and several folds are discernible on the surface. The nucleus becomes ellipsoidal in shape and contains one fairly large karyosome within.

Systematic position

This species bears close resemblance in general outline to *Stenophora nematoides* LEGER & DUBOSCQ 1903. The later is recently described in details by HUKUI 1952 on the specimens which are collected in Hukuoka, Japan. Both are elongate cylindrical curving on one side and are about equal in size of body and the ratio of length protomerite to total length. But this species differents from the other in some points, viz : the shape of the protomerite, which in this sepcies is subglobular, always wider than long and in *S. nematoides* is cylindrical, much longer than wide; the ratio of WP : WD is in this species 1 : 1.6 and in *S. nematoides* is 1 : 2—3 : the shape of the rudimentary epimerite is in this species more complex than in the latter species.

It shows such peculiar features in many respects that it can be classified as a new species.

25. *Stenophora triaugula* HUKUI 1951

Diagnosis : Sporonts solitary elongate cylindrical. Length 90—162μ, width 32—44μ. Ratio, LP : TL=1 : 8.1, WP : WD=1 : 2.2, WP : LP=1 : 1. Protomerite conical, but triangular on lateral view without epimerite, pore or invagination

at apex. Deutomerite elongate cylindrical, widest through middle but of almost same width throughout, rounded posteriorly. Endocyte light yellowish green, ectocyte thick, fine lnogitudinal striations in epicyte. Nucleus spherical, 16μ in diameter, with one large karyosome. Cyst spherical in diameter, spores undescribed.

Host : *Nedyopus patrioticus patrioticus* ATTEMS. Juliformia, Diplopoda.

Habitat : Oesophagus.

Locality : Seimon, Himehama (Fukuoka Prefecture)

26. *Stenophora nematoides* LEGER & DUBOSCQ 1903, partim, HUKUI, 1952.

Diagnosis : Sporonts solitary, elongate cylindrical, curved on one side. Average length 406μ, width 50μ. Ratio, LP : TL=1 : 2.5, WP : WD=1 : 17.7. Protomerite cylindrical, longer than wide, with a rudimentary epimerite at apex. Pore and invagination are seen there. Constriction at septum obscure. Deutomerite elongate cylindrical, without constriction through middle or at posterior region. Endocyte dark yellowish green. Nucleus ellipsoidal, 27×16μ with one karyosome.

Host : *Orthomorpha gracilis* (KOCH) Juliformia, Diplopoda.

Habitat : Intestine.

Locality : Fukuoka Prefecture.

27. *Stenophora ozakii* HUKUI 1952.

Diagnosis : Sporonts solitary, elongate cylindrical. Average length 373.5μ width 63μ. Ratio, LP : TL=1 : 20.8, WP : WD=1 : 2.8. Protomerite conical conspicuous constriction at septum. Detomerite elongate cylindrical, with constriction at posterior two-thirds or posterior three-fifths. Endocyte dark yellowish green deutomerite, light yellowish in protomerite. Nucleus ellipsoidal, situation variable. One karyosome. Epimerite none.

Host : *Orthomorpha gracilis* (KOCH) Juliformia, Diplopoda.

Habitat : Intestine.

Locality : Fukuoka Prefecture.

28. *Stenophora caudatum* (ISHII, 1915) WATSON 1922.

Diagnosis : Sporonts solitary, elongate. Length 112—400μ, width 32—100μ. Ratio, LP : TL=1 : 4.7—13.0. Protomerite conical but pentagonal in lateral view; slightly wider than long in adults and longer than wide in youngs; with an inconspicuous pore at apex. Deutomerite large and elongate, divided in two parts by constriction occuring at posterior half : anterior half ovoidal, swollen and posterior one elongate cylindrical, widens at posterior end in a small knob. Fine longitudinal striations run spirally in epicyte. Endocyte dense,

ectocyte well developed. Nucleus spherical, 20μ in diameter with karyosome.

Host : *Fontaria coarctata* POCOCK. Juliformia, Diplopoda.

Habitat : Intestine.

Locality : Mt. Kinkazan (Gifu Prefecture)

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PLATE I

Expanation of Plate

Figs. 1, 2. *Lecudina longissima* HOSHIDE.

Fig. 1. A young slender sporont.

Fig. 2. An adult sporont.

Fig. 3. *Lecudina mammilata* HOSHIDE, an adult sporont.

Figs. 4, 5. *Ferraria iwamusi* HOSHIDE.

Fig. 4. A cephalont.

Fig. 5. An adult sporont.

Figs. 6, 7. *Cochlemeritus lysidici* HOSHIDE.

Fig. 6. An adult sporont.

Fig. 7. A cephalont.

Fig. 8. *Lecudina longissima*, Two ripe spores.

Fig. 9. *Ferraria iwamusi* HOSHIDE, two spores.

Figs. 10–12. *Lecudina arabellae* n. sp.

Fig. 10. A young trophozoite, with epimerite.

Fig. 11. An adult sporont.

Fig. 12. The anterior portion of sporont, showing its epimerite and a nucleus.

Figs. 13–15. *Lecudian longissima*.

Fig. 13. A small swollen trophozoite.

Fig. 14. A trophozoite being parasited by *Metschnikovella*.

Fig. 15. Fairly large trophozoite.

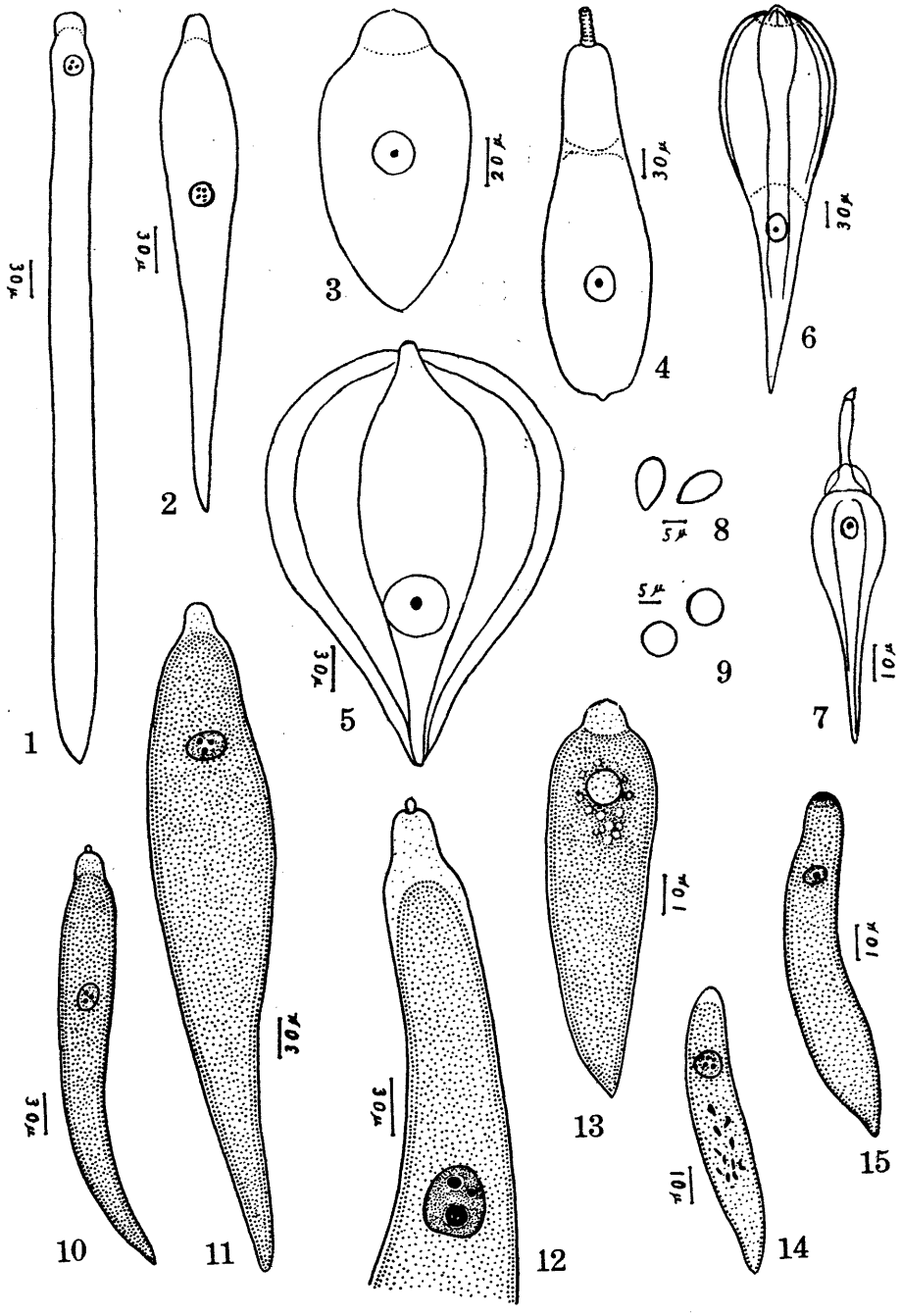
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PLATE II

Explanation of Plate

Figs. 16–18. *Lecudina amphora* n. sp.

Fig. 16. A young trophozoite with epimerite.

Fig. 17. An adult sporont.

Fig. 18. Anterior portion of a sporont.

Figs. 19–23. *Scia cirratuli* n. sp.

Fig. 19. An adult sporont.

Fig. 20. Another adult sporont in living sketched by specimen.

Fig. 21. A trophozoite contracting the epimerite.

Fig. 22. Streched epimerite.

Fig. 23. A cyst.

Fig. 24. *Cephaloidophora communis* MAURODIADI. An association.

Fig. 25–29. *Cephaloidophora punctata* n. sp.

Fig. 25. An adult association.

Fig. 26. Another adult association containing several deep stained bodies in the protoplasm.

Fig. 27. Interlocking device, by which satellite of association is attached to primite.

Fig. 28. A young trophozoite.

Fig. 29. Protomerite of primite.

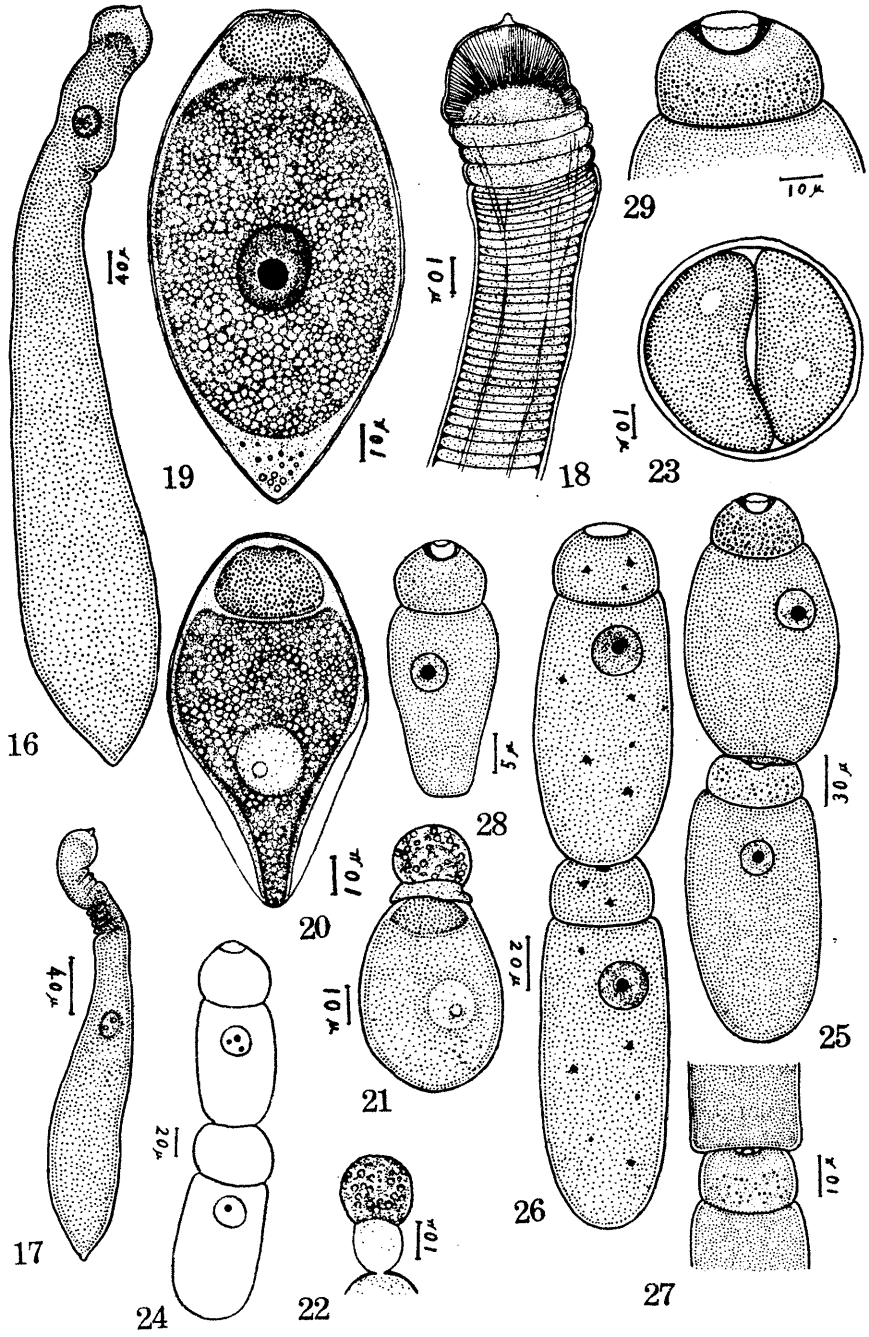
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PLATE III

Explanation of Plate

Fig. 30. *Cephaloidophora punctata* n. sp., an association of three sporonts.

Figs. 31—41. *Cephaloidophora setoutiensis* n. sp.

Fig. 31. A large adult association.

Fig. 32. A small association, swelling to cyst formation.

Fig. 33. An another association.

Fig. 34. A young trophozoite.

Fig. 35. A fairly developed trophozoite.

Fig. 36. Two sporonts in the process of rotation previous to cyst formation.

Fig. 37. Two sporonts just previous to cyst formation, they are attached completely.

Fig. 38. A cyst, the nuclei faintly visible.

Fig. 39. A cyst with numerous spherical spores.

Fig. 40. Two ripe spores.

Fig. 41. An apical lens-shaped papilla.

Fig. 42. *Cephaloidophora akayebi*. n. sp., an association.

Figs. 43—47. *Cephaloidophora lata* n. sp.

Fig. 43. A mature association.

Fig. 44. Two sporonts in the process of rotation previous to cyst formation. Two sporonts are not attached yet.

Fig. 45. A trophozoite.

Fig. 46. A cyst.

Fig. 47. Three ripe spores.

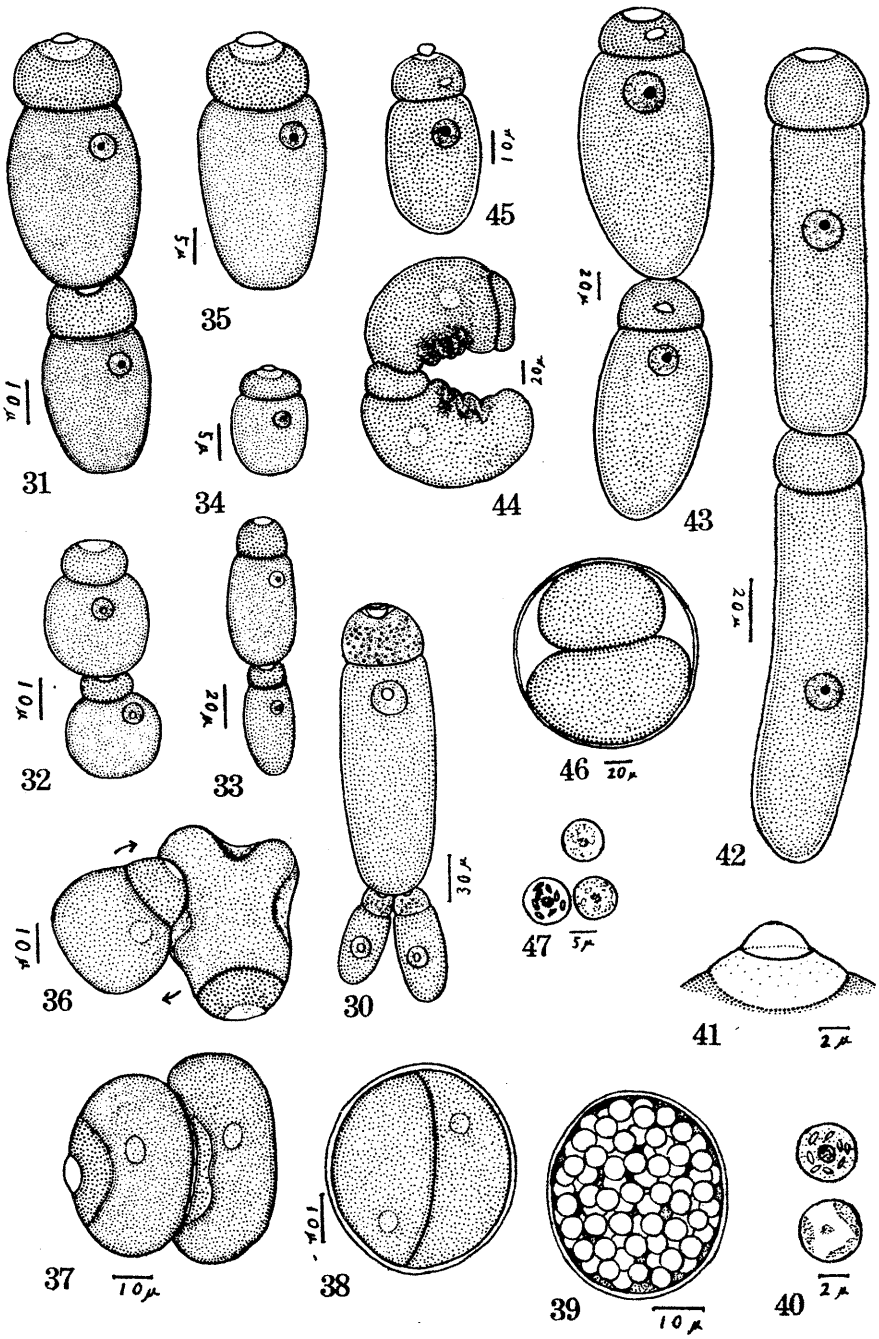
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PLATE IV

Explanation of Plate.

Figs. 48—56. *Carcinoecetes ozakii* n. sp.

Fig. 48. An association.

Fig. 49,a. The protomerite of primite, showing the apical disc and contents of protomerite and small part of deutomerite.

b. The interlocking region of association, showing flattened protomerite of satellite and nucleus of primite.

Fig. 50. Association of three sporonts.

Fig. 51. Young individual, with epimerite.

Fig. 52. Association at beginning of cyst formation, sporonts beginning to rotate.

Fig. 53. Association in process of rotation.

Fig. 54. The completed cyst. The nucleus of each sporont is still visible.

Fig. 55. A cyst filled with numerous spores.

Fig. 56. Two spherical spores.

Figs. 57—59. *Carcinoecetes japonicus* n. sp.

Fig. 57. An association.

Fig. 58. The protomerite of primite.

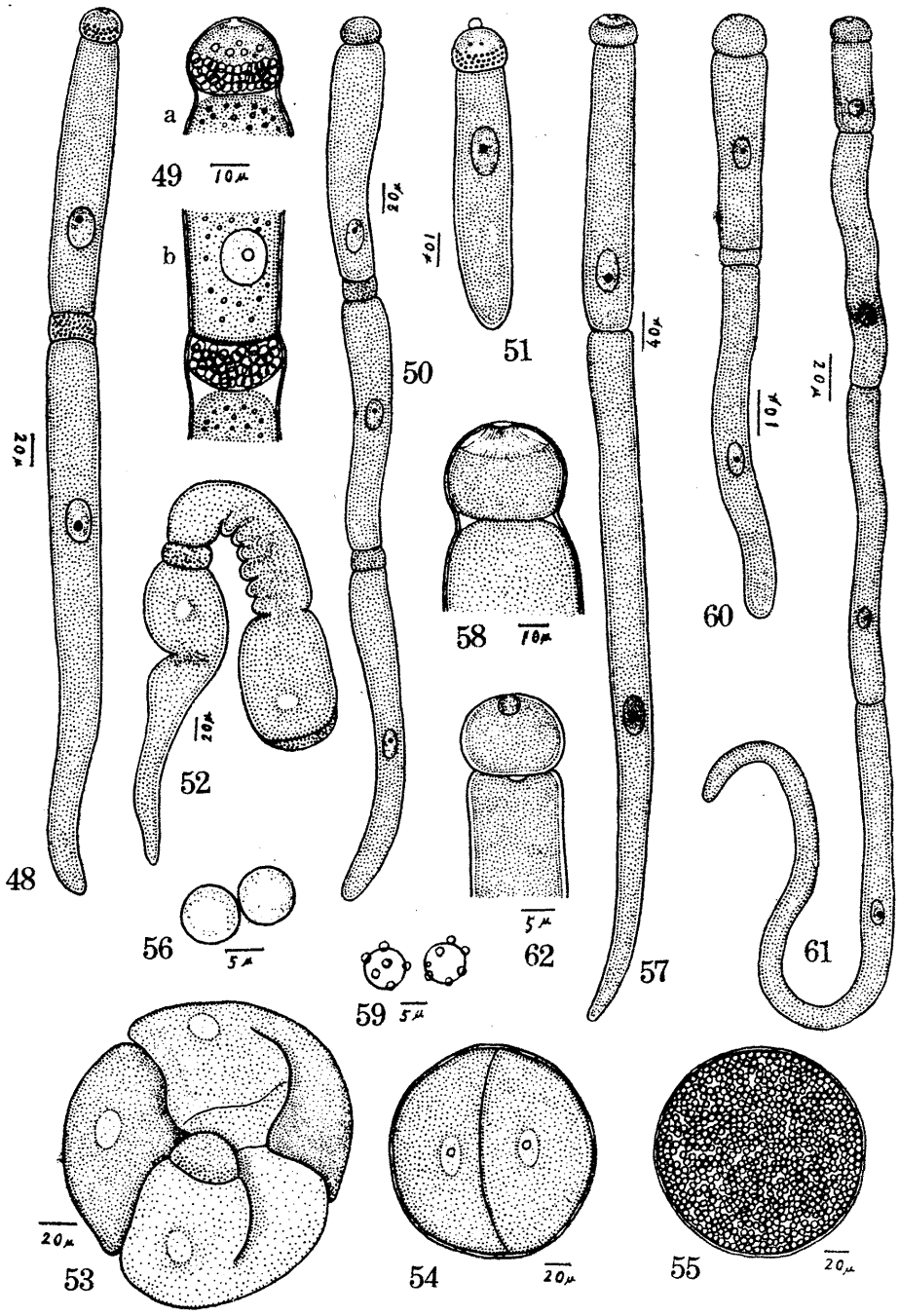
Fig. 59. Two spores, showing small paticles attached to its surface.

Figs. 60—62. *Carcinoecetes crangonophilus* n. sp.

Fig. 60. A small association.

Fig. 61. Association of four sporonts.

Fig 62. The protomerite of primite.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20μ
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20μ

PLATE V

Explanation of Plate

Figs. 63–65. *Stenophora fusiuli* HOSHIDE.

Fig. 63. An adult sporont, cylindrical form.

Fig. 64. An adult sporont. ovoidal form.

Fig. 65. An adult sporont, intermediate form.

Figs. 66, 67, 73. *Stenophora suhoensis* HOSHIDE.

Fig. 66. An adult sporont, contracted form.

Fig. 67. An adult sporont, elongate form.

Fig. 73. Three spores.

Figs. 68, 69, 72. *Stenophora murozumiensis* HOSHIDE.

Fig. 68. An adult sporont, contracted form.

Fig. 69. An adult sporont.

Fig. 72. Two spores.

Figs. 70, 71. *Stenophora orthomorphae* HOSHIDE.

Fig. 70. An adult sporont, cylindrical form.

Fig. 71. An adult sporont, broaden form.

Figs. 74–76, 79. *Cephaloidophora obatakeensis* n. sp.

Fig. 74. Mature sporonts association.

Fig. 75. Some other mature sporonts association.

Fig. 76. A trophozoite.

Fig. 79. Protomerite of the primite, enlarged view.

Figs. 77, 78, 80. *Cephaloidophora pagri* n. sp.

Fig. 77. An association of three aporonts.

Fig. 78. A trophozoite.

Fig. 80. Mature sporonts association.

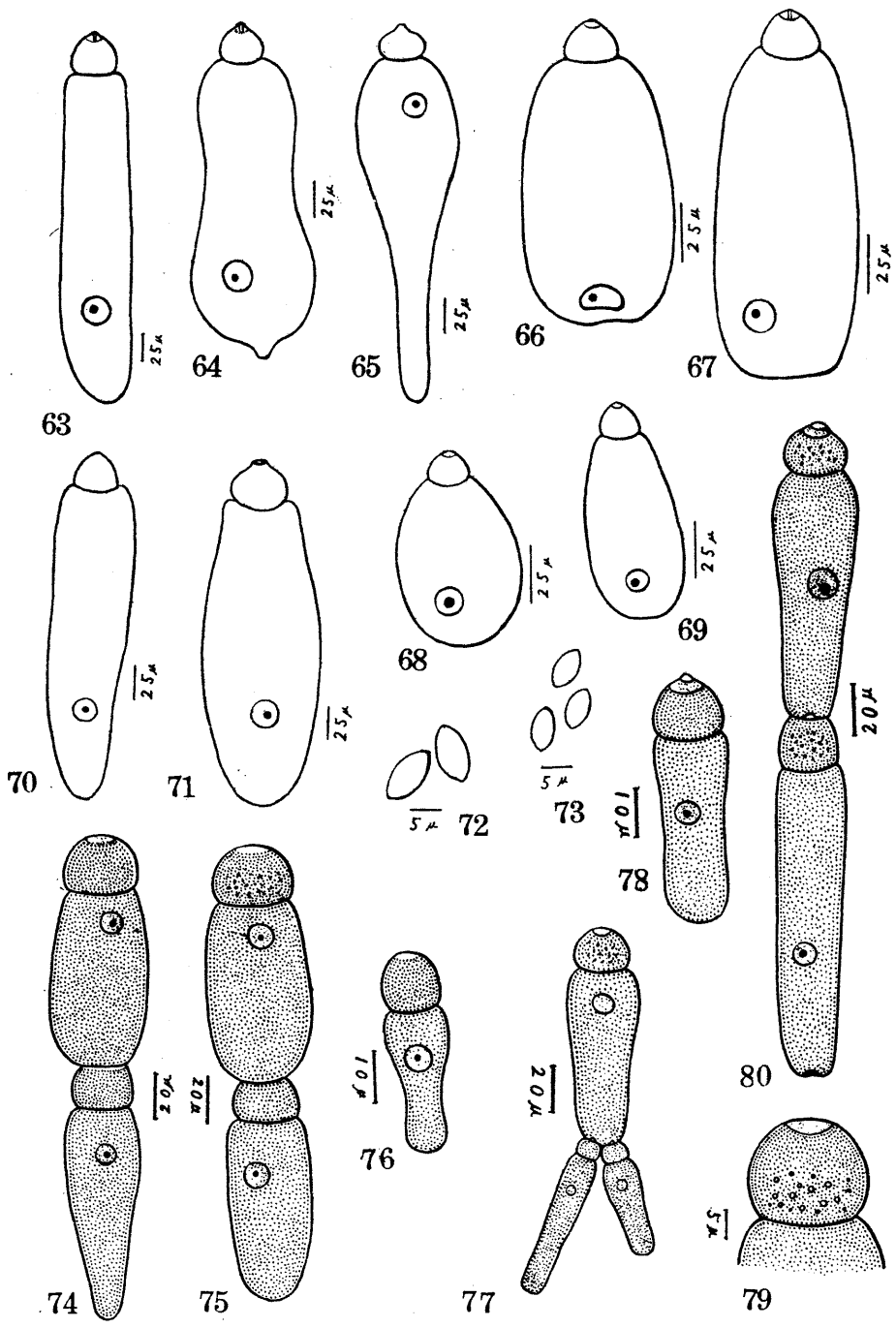
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PLATE VI

Explanation of Plate

Figs. 81–85. *Stenophora flexuosa* n. sp.

Fig. 81. An adult sporont.

Fig. 82. The protomerite, attached to the epithelial cell of the host gut, with an epimerite.

Fig. 83. The anterior portion of the body, showing the flexible, wavy folding of the upper part of the deutomerite.

Fig. 84. A trophozoite, with an epimerite.

Fig. 85. A younger sporont.

Figs. 86–88. *Stenophora hagiensis* n. sp.

Fig. 86. An adult sporont.

Fig. 87. The protomerite with epimerite.

Fig. 88. A younger trophozoite.

Figs 89–93. *Stenophora kojiroensis* n. sp.

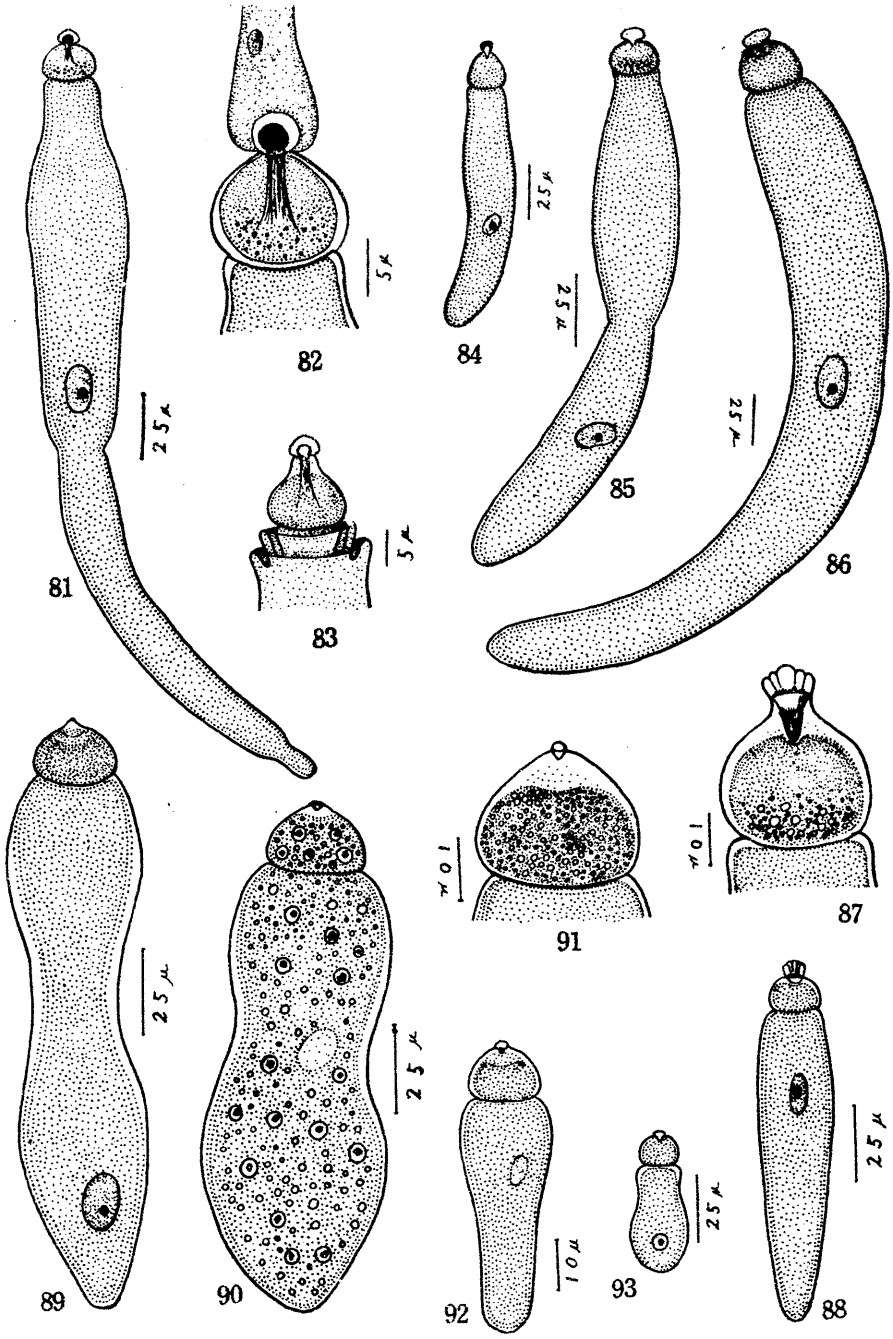
Fig. 89. An adult sporont.

Fig. 90. An adult sporont, contracted form, showing numerous globules with crystalloides within.

Fig. 91. The protomerite.

Fig. 92. A trophozoite.

Fig. 93. A younger trophozoite.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