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OHIO BIOLOGICAL SURVEY

BULLETIN 4

A REVIEW OF THE DESCRIBED SPECIES OF THE ORDER

Euglenoidina Bloch

CLASS FLAGELLATA (PROTOZOA) WITH PARTICULAR REFERENCE TO THOSE FOUND IN THE CITY WATER SUPPLIES AND IN OTHER LOCALITIES OF OHIO

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E^1 Chloroleucites disk form, more or less numerous.
F^1 Form radial not compressed; usually provided with two annular paramylon granules. 2. Gen. **Leptocinclis**
F^2 Form compressed; paramylon granules of various shapes. 3. Gen. **Phacus**
E^2 Chloroleucites in the form of two elongate lateral bands . 4. Gen. **Cryptoglena**
C^2 Provided with a brown or brownish-green protective covering which usually bears rugosities or spine like processes. . 5. Gen. **Trachelomonas**
B^2 Typically sessile (free swimming during part of reproductive cycle) and attached to minute crustacea, rotifers, filamentous algae, etc.
C^1 Not provided with a basal stalk; distinct protective envelope present . . 6. Gen. **Ascoglena**
C^2 Provided with a basal stalk; distinct protective envelope not present . . . 7. Gen. **Colacium**
A^2 Provided with two flagella; form bluntly conical with posterior end more or less pointed . . . 8. Gen. **Eutreptia**

1. Gen. EUGLENA Ehrenberg.

Form oblong or spindle shaped, contractile; free swimming; a single anterior flagellum; body covered by an elastic periplast often provided with minute elevations arranged spirally; on the anterior end a deep groove from the base of which arises a flagellum; an anterior stigma together with a complicated vacuole system consisting of a reservoir into which one or more small contractile vacuoles open; protoplasm containing green chromatophores (chloroleucites), together with paramylon bodies both differing greatly in form and position in the various species; nucleus large, centrally located with an interior nucleolar body.

Reproduction agamous through division occurring either in the free swimming stage, where it is usually longitudinal, or during an encysted stage, where the single cyst often divides into numerous smaller cysts. Conjugation has not been definitely demonstrated, although a sexual cycle probably occurs.

The species are found chiefly in stagnant fresh water, although a few are marine and one has been noted as parasitic in a species of Mesostoma, one of the Turbellarians, although not described.

Distribution, cosmopolitan.

TABLE OF SPECIES.

A[1] Chloroleucites (green chromatophores) present with the color rarely obscured by red hematochrome.

B[1] Chloroleucites in the form of more or less flattened rods or ribbons which may be arranged into a star shaped mass or otherwise distributed throughout the protoplasm.

C[1] Color green; species usually not exceeding 70μ in length.

D[1] Some of the chloroleucites collected into star-like masses.

E[1] Star-like masses 1-2 (rarely 3) in number.

F[1] Nucleus posterior; chloroleucites in a single median star-like mass. **1. E. viridis**

F[2] Nucleus median; chloroleucites in two or three star-like masses. . **2. E. geniculata**

E[2] Star-like masses more than three in number.

F[1] Posterior end pointed; pyrenoids without shell-like covering . **3. E. olivacea**

F[2] Posterior end rounded; pyrenoids with shell-like covering . **4. E. oblonga**

D[2] Chloroleucites not collected into star-like masses, but in the shape of elongated bands.

E[1] A single chloroleucite present.

F[1] Species extremely elongated; chloroleucite straight . . **5. E. elongata**

F[2] Species comparatively short; chloroleucite spiral . . . **6. E. minima**

E[2] Two or more chloroleucites present.

F[1] Two lateral chloroleucites . **7. E. pisciformis**

F[2] Chloroleucites in the form of numerous elongated bands.

G[1] Band like chloroleucites parallel with the longitudinal axis **8. E. terricola**

G[2] Band like chloroleucites arranged spirally . . **9. E. splendens**

C[2] Color normally red; species exceeding 70μ in length.

D[1] Periplast striated; length 120-225μ.

E[1] Caudal end acute; length approximately 120μ. . . . . **10. E. sanguinea**

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1. **E. orientalis** another red species with disk-like chloroleucites is noted on a succeeding page.

E² Caudal end more or less truncate; length *approximately* 200μ. . . . **11. E. rubra**
D² Periplast smooth; length 75-100μ. . **12. E. haematodes**
B² Chloroleucites in the form of flattened disks which are often much elongated and rarely with an irregular or extremely notched outline.
C¹ Length less than 5 times the diameter.
D¹ Prominent anterior and posterior paramylon granules not present.
E¹ Chloroleucites distinctly lobed.
F¹ Form elongately oval; length 95-100μ. . . . . **13. E. velata**
F² Form spindle shaped; length 85μ. **14. E. sociabilis**
E² Chloroleucites not distinctly lobed.
F¹ Length exceeding 55μ.
G¹ Pellicula with many small granules underneath arranged spirally. . . . . **15. E. granulata**
G² Pellicula without distinct granules underneath.
H¹ Color green.
I¹ Chloroleucites round or oval.
J¹ Pyrenoids present in chloroleucites; length 80-90μ. **16. E. polymorpha**
J² Pyrenoids absent in chloroleucites; length 60-70μ. **17. E. proxima**
I² Chloroleucites slightly constricted at middle, more or less dumb-bell shaped. **18. E. caudata**
H² Color red or yellowish red.
I¹ Cysts spherical in form. . . **19. E. flava**
I² Cysts flasklike in form **20 E. orientalis**
F² Length less than 50μ.
G¹ Form short cylindrical . **21. E. variabilis**
G² Form spindle shaped . **22. E. gracilis**
D² Prominent anterior and posterior paramylon granules present; length of individual approximately 60μ . . . . **23. E. torta**
C² Length more than 6 times the diameter.
D¹ Posterior part of body with an acute tip.
E¹ Periplast not covered with prominent punctuations arranged either spirally

or longitudinally.

F¹ Prominent anterior and posterior paramylom granules not present.

G¹ Body extremely metabolic; not normally twisted into a spiral however.

H¹ Chloroleucites in the form of flattened disks, numerous; posterior part of body with short acute tip . . . 24. **E. deses**

H¹ Chloroleucites in the form of elongate cup shaped disks, 2-4 in number; posterior part of body with elongated acute tip 25. **E. mutabilis**

G² Body not metabolic, normally twisted into a spiral . 26. **E. spiroides**

F² Prominent anterior and posterior* paramylon granules present.

G¹ Anterior part of body immediately in front of stigma nearly equal to the diameter of the median part of the body.

H¹ Anterior and posterior paramylon granules large, suboval or spherical.

I¹ Large paramylon granules, suboval; length of individual 375-500μ. . . 27. **E. oxyuris**

I² Large paramylon granules spherical; length of individual, 75μ. . . 28. **E. simulacra**

H¹ Anterior and posterior paramylon granules in the form of elongated rods; length of individual, 70-80μ.

I¹ Body exceedingly metabolic; not prolonged posteriorly into an extended acute tip; length, 120-135μ. 29. **E. intermedia**

* Occasionally lateral in **E. limnophila.**

I² Body not metabolic; prolonged posteriorly into an extended acute tip; length, 70-80μ. . . 30. **E. tripteris**

G² Anterior part of body immediately in front of stigma approximately one-half the diameter of the median part.

H¹ Posterior end not developed into a needle-like tip . . 31. **E. acus**

H² Posterior end developed into a needle-like tip.

I¹ Chloroleucites not spirally arranged; length, 80μ. . . . 32. **E. limnophila**

I² Chloroleucites spirally arranged; length 125μ 33. **E. acutissima**

E² Periplast covered with prominent punctuations, arranged either spirally or longitudinally.

F¹ Flagellum short; punctuations arranged spirally. . . . 34. **E. spirogyra**

F² Flagellum as long as body; punctuations, arranged longitudinally 35. **E. fusca**

D² Posterior part of body with a rounded or truncate tip.

E¹ Paramylon granules in the form of elongate rods; tip of body rounded; length, 250-300μ. . . . 36. **E. ehrenbergii**

E² Paramylon granules not rod-like; tip truncate or emarginate; length, 175μ. 37. **E. truncata**

A² Chloroleucites apparently absent and the individuals colorless; stigma yellow to orange brown. . . 38. **E. quartana**

*1. **E. viridis** Ehrenb (Fig. 1, Pl. XII).

Oval or fusiform; periplast striated spirally; flagellum as long as body; stigma prominent; nucleus posterior; chloroleucites in the form of elongated rods collected into a median stellate mass; paramylon granules small, round or oval, with pyrenoids.

Reproduction by longitudinal division or by encystment in a spherical state with thickened membrane colored a yellowish brown.

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* Species from Ohio.

L 50-60μ. D. 14-18μ.

(var. *olivacea* L. 72-80μ. D. 16μ.)

Distribution, cosmopolitan. Storage Dam, Columbus.

Many other species have been erroneously classified as *E. viridis* in ordinary biological instruction. The posterior position of the nucleus, together with the single stellate group of chloroleucites, should easily distinguish it from several closely allied forms. The following varieties have been noted: var. *mucosa* Lemm., surrounded by mucous in swimming stage and only slightly metabolic; var. *olivacea* Klebs, distinguished primarily by the olive green color of the chloroleucites and the tendency of these to be separated into disciform fragments, together with the larger size of the form. Dangeard has suggested that the var. *hyalina* Klebs possibly belongs to the genus Astasia, inasmuch as it is deprived of chlorophyl and possesses only a rudimentary stigma.

Hiawatha Lake, Mt. Vernon, O.; Kokosing River, Gambier, O.

*2. **E. geniculata** Dujard (Fig. 2, Pl. XII).

Cylindrical elongate with periplast striated spirally; flagellum as long as body; stigma prominent; nucleus central; chloroleucites in the form of elongate rods collected into 2 or 3 stellate masses, one mass posterior to the nucleus; paramylon with pyrenoids.

Reproduction by longitudinal division, or by encystment without thickened membrane as in *E. viridis*.

L. 70-85μ. D. 12-22μ.

Distribution, cosmopolitan. Storage Dam, Columbus.

3. **E. olivacea** Schmitz (Fig. 3, Pl. XII).

Fusiform, short posteriorly, metabolic; periplast striated spirally; flagellum as long or longer than the body; chloroleucites numerous, stellate; pyrenoids not covered with paramylon; paramylon granules short, oval.

Reproduction by longitudinal division. Encystment not known.

L. 68-89μ. D. 14-21μ.

Distribution, cosmopolitan.

4. **E. oblonga** Schmitz (Fig. 4, Pl. XII).

Oval, short with rounded ends; periplast spirally striated; flagellum longer than body; nucleus central;(?); chloroleucites numerous, *stellate; pyrenoids with shell; paramylon (?).*

Reproduction (?).

L. 50-70μ. D. 25-35μ.

Distribution (?)

5. **E. elongata** Schew. (*Fig.* 5, Pl. XII).

Extremely elongate, fusiform, scarcely metabolic; periplast smooth; flagellum 2/3 length of body; nucleus slightly posterior; *chloroleucites elongated bands; pyrenoids absent; paramylon* (?).

Reproduction (?).

L. 64μ. D. 5-6μ.

Distribution, New Zealand in cold springs.

6. **E. minima** Francé (Fig. 6, Pl. XII).

Small, fusiform, extremely metabolic; periplast weakly striate spirally; flagellum ½ body length; nucleus (?); chloroleucites in form of spiral bands; pyrenoids 2, with shells; paramylon small, rods.

Reproduction by longitudinal division; cysts (?).

L. 27μ. D. 8-9μ.

Distribution, cosmopolitan (?) in swamps.

*7. **E. pisciformis** Klebs (Fig. 7, Pl. XII).

Fusiform, rounded anteriorly, short posteriorly, slightly metabolic; periplast weakly striate spirally; flagellum as long as body; stigma with prominent granulation; nucleus posterior (?); chloroleucites 2 or 3 (?) in number arranged longitudinally and nearly as long as body; pyrenoid with double shell; paramylon (?).

Reproduction by cysts forming several cells (8?) within a single membrane.

L. 25-30μ. D. 5-7μ.

(var. *minor* L. 18-20μ. D. 4.5-5μ.)

Distribution, cosmopolitan.

The var. *minor* Hansg. has a length of 18-20μ and a diameter of 4.5-5μ. *E. pisciformis* is a small species with swimming movements analogous to those of a fish, whence the name. The body becomes metabolic to a slight extent when the individual ceases swimming.

Gambier, O. Pool "Hotel Hill," var. *minor* (18μ in length).

8. **E. terricola** (Dang.) (Fig. 8, Pl. XII).

Cylindrical, elongate, tip distinct, decidedly metabolic; periplast weakly striate spirally; flagellum ½ length of body; nucleus central; chloroleucites numerous, band-like, arranged longitudinally posterior to nucleus; pyrenoids 2, enclosed in paramylon; paramylon granules small, short, cylindrical.

Reproduction.

L.(?). D.(?).

Distribution, cosmopolitan(?).

9. **E. splendens** Dang. (Fig. 9, Pl. XII).

Oval with short tip; periplast with prominent punctuations arranged spirally; flagellum longer than the body; nucleus central; chloroleucites numerous, ribbon-like, arranged spirally between striate punctuations; pyrenoids absent; paramylon round, rarely rod-like.

Reproduction by longitudinal division. Encystment with division in spherical condition.

L. 70-80μ. D. 22-27μ.

Distribution, France, Casette near Potiers.

Distinguished from other species by the peculiar arrangement of chloroleucites, more numerous and shorter than in *E. sanguimea* and without pyrenoids.

*10. **E. sanguinea** Ehrenb (Fig. 10, Pl. XII).

Elongately oval, red, fusiform to cylindrical, with short tip, metabolic; periplast striate spirally with indistinct punctuations; flagellum 2 times length of body; chloroleucites in the form of rods or ribbons or extremely notched disks; pyrenoid with shell; paramylon round or oval; green chlorophyl of the chloroleucites obscured by the red haematochrome which may however disappear in small aquaria with changed metabolism.

Reproduction by copulation of gametes. Encystment with *division in spherical state*, the gelatinous envelope thick.

L. 55-120μ. D. 28-33μ.

Distribution, cosmopolitan.

An interesting species which at times colors pools and small ponds an intense red on the surface. In the var. *furcata* Hübner the cell is narrowed anteriorly so that a neck-like appearance results, while a spiral furrow reaches from the cytopharynx to the middle of the body.

Ohio, Cedar Point; Sandusky, in quarry ponds.

11. **E. rubra** Hardy (*Fig. Pl. XII*).

Cylindrical, red, with broadly rounded anterior end and posterior end suddenly narrowed into a distinct tip which is rounded posteriorly; periplast spirally striate; flagellum approximately as long as body; chloroleucites(?); pyrenoids(?); nucleus slightly posterior; paramylon short cylindrical.

Reproduction by encystment with formation of distinct membrane.

L. 150(?)-200μ. D. 50(?)-60μ.

Distribution, cosmopolitan. Australia; Europe, Bohemia.

The species was described by Hardy, 1911, in association with *E. viridis* in small pools at Donocaster, Australia, and more recently it has been noted from Bohemia. It appears quite distinct from *E. sanguinea.*

12. **E. haematodes** (Ehrenb), (Fig. 12, Pl. XII).

Fusiform, red, metabolic; periplast smooth; flagellum 1½-2 times length of body; stigma absent(?); chloroleucites in the form of rods and ribbons (notched disks ?); pyrenoids (?); paramylon round or oval; protoplast colored red by haematochrome.

Reproduction by longitudinal division. Encystment with a thick membrane and subsequent division.

L. 75-103μ. D. 28-36μ.

Distribution, cosmopolitan(?).

*13. ***E. velata*** *Klebs (Fig. 13, Pl. XII).*

Elongately oval with short tip, rounded anteriorly, metabolic; periplast weakly striate spirally; flagellum as long or somewhat shorter than the body; nucleus large, median; stigma large, granu-

lar; chloroleucites 20-30 in number, distinctly lobed; pyrenoids double shelled; paramylon (?).

L. 90-100μ. D. 25-30μ.

Distribution, Europe and North America; Ohio, Gambier, Brook, McElroy Farm, with filaments of Lyngbya.

14. E. sociabilis Dang. (Fig. 1, Pl. XIII).

Fusiform with short tip, metabolic; periplast (?) flagellum longer than body; nucleus (?); chloroleucites numerous—about 10 in number; pyrenoids double shelled; paramylon oval or rod-like.

Reproduction by encystment with subsequent division resulting in spherical colonies of 2, 4, or 8 cells each with stigma and nucleus distinct.

L. 85μ. D. 25μ.

Distribution, France.

15. E. granulata (Klebs), (Fig. 2, Pl. XIII).

Fusiform with short tip, metabolic; pellicula spirally striate, yellowish brown with distinct punctuations; flagellum as long as body; nucleus central; chloroleucites in the form of large disks with slightly irregularly borders, each containing a prominent pyrenoid; paramylon (?).

Reproduction by encystment within a gelatinous envelope.

L. 60-90μ. D. 20-25μ.

Distribution, Europe. Cosmopolitan (?)

The var. *luteo* Lemm. is colored light green.

***16. E. polymorpha** Dang. (Fig. 3, Pl. XIII).

Oval approaching cylindrical, metabolic with short tip; periplast striated spirally, light brown in color; flagellum twice as long as body; nucleus central (?); chloroleucites 15 or more in number in the form of disks with irregular borders, each containing a pyrenoid; paramylon oval, often absent.

Reproduction, encystment spherical with gelatinous membrane.

L. 80-90μ. D. 20-25μ.

First found by Dangeard near Potiers in company with *E. sanguinea.*

Mirror Lake, O. S. U., O., from stems of *Eleodea.* Length 93μ.

*17. **E. proxima** Dang. (Fig. 4, Pl. XIII).

Fusiform, not elongately cylindrical with colorless tip, metabolic; periplast *spirally striate*; *flagellum* 1-1½ *times* length of body; nucleus central; *chloroleucites numerous, disciform, about* 50 in each individual; pyrenoids absent; paramylon small, elongately oval or annular(?).

Reproduction by encystment with cysts spherical, two cells being formed in a common envelope.

L. 60-70μ. D. 20μ.

Distribution, France, Potiers. Storage Dam, Columbus.

The elongately oval *chloroleucites suggests a form somewhat* intermediate between those possessing elongated rods and those with flattened disks.

18. **E. caudata** Hübner (Fig. 5, Pl. XIII).

Broadly *fusiform with narrowed elongate tip, metabolic;* periplast spirally striate; *flagellum as long as body; nucleus central*; chloroleucites numerous, dumb-bell shaped; pyrenoids with a double shell; paramylon(?).

Reproduction(?).

L. 110μ. D. 38μ.

Distribution, Europe(?).

19. **E. flava** Dang. (Fig. 6, Pl. XIII).

Fusiform with short tip, red, metabolic; periplast(?); flagellum about length of body; nucleus(?); chloroleucites 3-15 in number, *disciform*; pyrenoids with double shell; paramylon(?).

Development by longitudinal division. Encystment with spherical cysts.

L. 60μ. D. 25-30μ.

Distribution, France at Potiers.

20. **E. orientalis** Kashyop (Fig. 7, Pl. XIII).

Fusiform approaching cylindrical, color red; periplast(?); flagellum about as long as body; chloroleucites globular; pyrenoids(?); paramylon disiform, about 7μ in diameter.

Reproduction by flask shaped cysts from which it escapes laterally.

L. 60-120μ. D. 25(?)-40(?)μ.

Distribution, East India, Lahore.

A species apparently quite distinct by reason of flask-like cysts and development of haematochrome.

*21. **E. variabilis** Klebs (Fig. 8, Pl. XIII).

Cylindrical, short, rounded anteriorly, decidedly metabolic; periplast strongly striate spirally; flagellum 2-3 times length of body; nucleus (?); stigma large, dark red; chloroleucites disciform, without pyrenoids; paramylon one large granule anteriorly, many small granules (?).

Reproduction by division while provided with thin gelatinous envelope.

L. 30-46μ. D. 9-13μ.

Distribution, cosmopolitan.

Gambier, O., Hotel Hill Spring. A form which may at least be placed as a variety of the above, although not agreeing in detail with the figure from Klebs.

22. **E. gracilis** Klebs (Fig. 9, Pl. XIII).

Cylindrical to bluntly oval without pronounced tip, decidedly metabolic; periplast spirally striate; flagellum about length of body; nucleus central; chloroleucites 12-15 in number, disciform with irregular margin; with pyrenoids; paramylon absent (?).

Reproduction by division while provided with thin gelatinous membrane. Encystment with thick gelatinous membrane.

L. 37-45μ. D. 6-22μ.

Distribution, France, Potiers.

A small but exceedingly active species.

*23. **E. torta** Stokes (Fig. 10, Pl. XIII).

Elongately fusiform with tip twisted, not metabolic (?); flagellum as long as body; periplast smooth; chromatophores (?); pyrenoids (?); paramylon in the form of 2 long rod-like granules anterior and posterior to the nucleus.

Reproduction by division.

L. 63μ. D. (?).

Distribution, United States.

This species described by Stokes is closely allied to *E. tripteris* and may prove identical with that form.

Ohio, Milford Center.

*24. **E. deses** Ehrenb. (Fig. 1, Pl. XIV).

Elongately cylindrical or band-like in form with short tip, metabolic; periplast weakly striate spirally; flagellum short; nucleus large, oval, central; stigma prominent; chloroleucites numerous, disciform; pyrenoids without shell; paramylon in the form of short or elongate rods.

Reproduction by division with or without encystment in a gelatinous covering.

L. 70-200μ. D. 17-24μ.

Distribution, cosmopolitan. Gambier, O.

The species is not free swimming but constantly undergoing contortions.

25. **E. mutabilis** Schmitz (Fig. 2, Pl. XIV).

Elongately cylindrical, slightly narrowed anteriorly, tip elongate, decidedly metabolic; periplast smooth; flagellum (?); chloroleucites 2-4 in number in the form of entire or a single half of hollow cylinders; pyrenoids 2, without shell; paramylon small, rod-like or disk-like.

Reproduction by cysts, fusiform or cask-like in appearance.

L. 80-90μ. D. 7μ.

A species particularly noticeable by reason of its comparative length.

26. **E. spiroides** Lemm. (Fig. 3, Pl. XIV).

Spirally twisted in the form of an elongate band with tip at a pronounced angle; periplast weakly striate longitudinally; flagellum short; nucleus central (?); chloroleucites numerous, disciform; pyrenoids absent; paramylon round, small.

Reproduction (?).

L. 60-170μ. D. 16μ.

Distribution, Europe.

*27. **E. oxyuris** Schmarda (Fig. 4, Pl. XIV).

Extremely elongate cylindrical or slightly flattened, rounded anteriorly, posteriorly with elongate tip, form usually twisted; periplast decidedly striate spirally; flagellum ½ length of body; nucleus central; chloroleucites numerous, disciform; pyrenoids absent; paramylon in the form of 2 large annular elongate rings, one anterior, the other posterior to the nucleus.

Reproduction by longitudinal division. Encystment not known.

L. 375-490μ. D. 30-45μ.

Distribution, cosmopolitan.

The species is a large and interesting one, extremely well adapted for biological instruction in laboratory work. After once having found a locality it may be obtained in abundance. Longitudinal division of the mature form has been observed to take place within five hours without the reconstruction of the second paramylon granule. This was from aquarium material during midwinter, but at ordinary room temperature during the day.

Ohio, Gambier; E. Swamp on S. Bass Island, Lake Erie (Jennings); Sandusky Basket Factory Cove, L. Erie (Landacre).

*28. **E. simulacra** n. sp. (Fig. 5, Pl. XIV).

Elongately cylindrical or slightly flattened, rounded anteriorly, posteriorly with long acute tip, metabolic; periplast without pronounced spiral striations; chloroleucites disciform, numerous; pyrenoids(?); paramylon in the form of two large spherical granules, one anterior and one posterior to the nucleus, which is round.

Reproduction(?).

L. 75μ. D. 8-8.5μ.

Distribution, Ohio, Fremont.

This interesting species is described from several specimens observed May 6, 1913, obtained in cultures procured from Fremont, O., early in the spring. It differs from *E. oxyuris* by the presence of two large spherical instead of oval paramylon granules, by the rounder nucleus and by its much smaller size. All the forms observed were nearly identical in size. Camera lucida drawings were made. No swimming movements took place, but instead a series of slow, twisting contortions.

29. **E. intermedia** (Klebs), (Fig. 6, Pl. XIV).

Elongately cylindrical with short tip, decidedly metabolic; periplast weakly striate spirally; flagellum short; chloroleucites disciform, numerous; pyrenoids absent; paramylon consists of 2-3(?) large rod-like granules anterior and posterior to the nucleus.

Reproduction, division in gelatinous membrane.

L. 120-135μ. D. 8-12.5μ.

Distribution, Europe.

The var. *klebsii* Lemm. is 78-80μ long, 7-8μ in diameter and has rod-like paramylon granules much shorter.

*30. **E. tripteris** (Dujard.), (Fig. 7, Pl. XIV).

Elongately band-like in form, spirally twisted with very long and acute tip, not metabolic; when swimming three definite areas are formed by the body; periplast weakly striate longitudinally; flagellum ½ length of body; chloroleucites numerous, disciform; pyrenoids absent; paramylon in the form of 2 elongate rod-like granules, one anterior and the other posterior to the nucleus.

Reproduction by division without formation of thickened membrane.

L. 70-80μ. D. 8-14μ.

Distribution, cosmopolitan.

The species appears rather rare, but is easily known by its peculiar tripartate areas when swimming. It is not metabolic.

Ohio, Gambier (Academy Pond); Milford Center.

*31. **E. acus** Ehrenb. (Fig. 8, Pl. XIV).

Extremely elongate, fusiform, tip attenuate, weakly metabolic; periplast weakly striated spirally; flagellum about 1/3 length of body; nucleus central, oval; chloroleucites numerous, discoid; pyrenoids absent; paramylon elongate rods, usually 7-12 in number, scattered through protoplast.

Reproduction (?).

L. 70-200μ. D. 7-12μ.

Distribution, cosmopolitan.

Two varieties have been recognized, var. *minor* Hansg. 70-75μ long and 4-6μ in diameter, from peat bogs, and var. *rigida* Hübner, extremely rigid, 110μ long and 7.5μ in diameter, with paramylon arranged spirally. The species is not found commonly. Dangeard notes only isolated examples from two localities in France. The Hiawatha Lake forms are somewhat larger than the dimensions (180μ) ordinarily given.

Ohio, Mt. Vernon (Hiawatha Lake); Milford Center; Sandusky (Landacre), in vegetation from basket factory cove.

32. **E. limnophila** Lemm. (Fig. 9, Pl. XIV).

Fusiform with straight or slightly bent needle-like tip, slightly metabolic; periplast scarcely striate; flagellum short;

chloroleucites numerous, discoid; pyrenoids absent; paramylon the form of 1-2 elongate rods anterior and posterior or lateral the nucleus.

Reproduction (?).

L. 82μ. D. 10μ.

Distribution, Europe.

*33. **E. acutissima** Lemm. (Fig. 10, Pl. XIV).

Elongately fusiform, rigid, with needle-like tip; peripla weakly striate spirally; flagellum short; chloroleucites numerou discoid, arranged in spiral lines: pyrenoids absent; paramylon i the form of 2 elongate rods, one anterior, the other posterior t the nucleus.

Reproduction (?).

L. 123μ. D. 7μ.

Distribution, cosmopolitan.

Ohio, Fremont.

*34. **E. spirogyra** Ehrenb. (Fig. 1, Pl. XV).

Elongately cylindrical, narrowed anteriorly while posteriorl produced into an acute tip often slightly bent into a crescent shape, slightly metabolic; periplast yellowish brown with prom nent spiral punctuations, a prominent row often alternating wit a less prominent row; flagellum short; chloroleucites numerou discoid; pyrenoids absent; paramylon in the form of 2 prominer annular granules, the one anterior, the other posterior to th nucleus.

Reproduction by longitudinal division and by cysts withou a gelatinous envelope.

L. 80-150μ. D. 6-20μ.

Distribution, cosmopolitan.

Three varieties have been recognized, var. *abrupte-acuminat* Lemm., 125μ in length and 15μ in diameter with alternate prom nent and weak rows of punctuations, and the tip distinctly set o from the rest of the cell; var. *laticlavius* (Hübner), 130μ in lengt and 20μ in diameter with weakly but uniformly developed row of punctuations, and var. *marchia* Lemm., 79-100μ in length an 6-12μ in diameter with equally developed rows of punctuation which are almost in contact with one another.

The forms thus far observed by the writer from Ohio are larger than any hitherto recognized, with L. 150μ and D. 20μ.

Ohio, Gambier (Acad. Pond, Bishops Pool); E. Swamp, S. Bass Island, and Portage River (Jennings); Sandusky, L. Erie, basket Factory Cove (Landacre).

35. **E. fusca** (Klebs), (Fig. 2, Pl. XV).

Elongate band-like in form, gradually narrowed posteriorly with short tip, weakly metabolic; periplast dark brown to black with longitudinal rows of distinct punctuations; flagellum as long as body; chromatophores numerous, discoid; pyrenoids absent; paramylon in the form of 2 large annular granules, anterior (?) and posterior to the nucleus.

Reproduction by longitudinal (?) division and by cysts without gelatinous covering.

L. 90-225μ. D. 23-27.5μ.

Distribution, Europe.

This was originally described as a variety of *E. spirogyra* by Klebs but later given a specific rank by Lemmerman.

36. **E. ehrenbergii** Klebs (Fig. 3, Pl. XV).

Elongately band-like in form with rounded ends, decidedly metabolic; periplast weakly striate spirally; flagellum less than length of body; chloroleucites numerous, discoid; pyrenoids absent (?); paramylon in the form of elongate cylindrical rods which at times are somewhat flattened or even discoid.

Reproduction (?).

L. 290μ. D. 26μ.

Distribution, Europe.

*37. **E. truncata**; n. sp. (Fig. 4, Pl. XV).

Elongately cylindrical or band-like in form, slightly metabolic and often assuming a twisted appearance; periplast spirally striate; flagellum less than length of body; nucleus anterior, oval; posteriorly body normally emarginate or truncate; chloroleucites numerous, discoid, 2.5μ in diameter; pyrenoids apparently absent; paramylon with large granules absent, but with many small granules about 1.5μ in diameter and 2μ in length.

Reproduction (?).

L. 175μ. D. 27-29μ.

Distribution, Mt. Vernon (Hiawatha Lake), O.

This species has been found in almost all cultures from H watha Lake, at Hiawatha Park, Mt. Vernon, during a period three years. Large paramylon granules are absent, while t emarginate posterior end of the body is a character of intere The body is often twisted into bipartate or tripartate areas simil to *E. tripteris*.

The species is allied to *E. ehrenbergii* Klebs to which *Amb ophis viridis* Ehrenb. (Kent, V. 1, p. 386) must be referred b differs by the characters in the "Table." *Amblyophis aegyptic* Schmarda (fresh water Egypt) is not sufficiently described to pla it with certainty, systematically.

38. **E. quartana** Moroff (Fig. 5, Pl. XV).

Colorless, fusiform, gradually narrowed behind, decide metabolic; periplast distinctly differentiated, thick but smoo flagellum 1½ times length of body; nucleus in posterior third body; chloroleucites absent; paramylon granules usually oval, co paratively large.

Reproduction (?).

L. 50μ. D. 15μ.

Distribution, Germany (Munich).

The species was described by Moroff in cultures made fr drainage water at Munich in which Beggiota had developed quantities. It should be regarded as a valid species with so doubt by reason of the possible loss of the chlorophyl due to a ficial conditions.

2. Gen. LEPTOCINCLIS Perty.

Forms radial not compressed usually with periplast stri spirally, not metabolic. Flagellum and vacuole system as Euglena. Chloroleucites numerous, disciform in form and r mally contiguous to the pellicula. Usually provided with two la lateral annulate paramylon granules. Reproduction through vision in a resting stage. Nourishment holophytic or saprophy

Distribution, cosmopolitan.

1. **D. griseolum** Perty (Fig. 11, Pl. XXVI).

Elongately oval with rounded ends; periplast spirally striate with ectoplasm containing granules arranged spirally; primary flagellum as long as body; secondary flagellum 1½ times length of body.

L. 76-80μ. D. 30-40μ.

PLATE XII

1. *Euglena viridis* Ehrenb., x 500 (Walton).
2. *Euglena geniculata* Dujard., x 500 (Dangeard).
3. *Euglena olivacea* Schmitz, x 500 (Lemmermann).
4. *Euglena oblonga* Schmitz, x 500 (Schmitz).
5. *Euglena elongata* Schw., x 500 (Schewiakoff).
6. *Euglena minima* Francé, x 1000 (Francé).
7. *Euglena pisciformis* Klebs, var. *minor*, x 1000 (Walton).
8. *Euglena terricola* (Dangeard), x 500 (Lemmermann).
9. *Euglena splendens* Dangeard, x 500 (Dangeard).
10. *Euglena sanguinea* Ehrenberg, x 500 (Haase).
11. *Euglena rubra* Hardy, x 500 (Hardy).
12. *Euglena haematodes* (Ehrenberg), x 500 (From description).
13. *Euglena velata* Klebs, x 500 (Dangeard).

PLATE XIII

1. *Euglena sociabilis* Dangeard, x 500 (Dangeard).
2. *Euglena granulata* (Klebs), x 500 (Hübner).
3. *Euglena polymorpha* Dangeard, x 500 (Dangeard).
4. *Euglena proxima* Dangeard, x 500 (Dangeard).
5. *Euglena caudata* Hübner, x 500 (Lemmermann).
6. *Euglena flava* Dangeard, x 500 (Lemmermann).
7. *Euglena orientalis* Kashyop, x 500 (From description).
8. *Euglena variabilis* Klebs, x 500 (Klebs).
9. *Euglena gracilis* Klebs, x 500 (Lemmermann).
10. *Euglena torta* Stokes, x 500 (Stokes).

PLATE XIV

1. *Euglena deses* Ehrenberg, x 500 (Walton).
2. *Euglena mutabilis* Schmitz, x 500 (Schmitz).
3. *Euglena spiroides* Lemmermann, x 500 (Lemmermann).
4. *Euglena oxyuris* Schmarda, x 250 (Walton).
5. *Euglena simulacra* n. sp., x 500 (Walton).
6. *Euglena intermedia* (Klebs), x 500 (Lemmermann).
7. *Euglena tripteris* Dujard., x 500 (Walton).
8. *Euglena acus* Ehrenberg, x 500 (Walton).
9. *Euglena limnophila* Lemmermann, x 500 (Lemmermann).
10. *Euglena acutissima* Lemmermann, x 500 (Lemmermann).

PLATE XV

1. *Euglena spirogyra* Ehrenberg, x 500 (Walton).
2. *Euglena fusca* (Klebs), x 500 (Hübner).
3. *Euglena ehrenbergii* Klebs, x 250 (Lemmermann).
4. *Euglena truncata* n. sp., x 250 (Walton).
5. *Euglena quartana* Moroff, x 500 (Maroff).
6. *Leptocinclis ovum* (Ehrenberg), x 1000 (Stein).
7. *Leptocinclis sphagnophila* Lemmermann, x 1000 (Zacharias).
8. *Leptocinclis steinii* Lemmermann, x 1000 (Stein).
9. *Leptocinclis buetschlii* Lemmermann, x 1000 (Bütschli).
10. *Leptocinclis teres* (Schmitz), x 1000 (Schmitz).

PLATE XVI

1. *Leptocinclis fusiformis* (Carter), x 1000 (Lemmermann).
2. *Leptocinclis acicularis* Francé, x 1000 (Francé).
3. *Leptocinclis texta* (Dujard.), x 1000 (Lemmermann).
4. *Leptocinclis globosa* Francé, x 1000 (Francé).
5. *Leptocinclis marssonii* Lemmermann, x 1000 (Lemmermann).
6. *Phacus anacoelus* Stokes, x 500 (Stokes).
7. *Phacus alata* Klebs, x 500 (Dangeard).
8. *Phacus orbicularis* Hübner, x 500 (Hübner).
9. *Phacus pleuronectes* (Mull.) x 500 (Lemmermann).
10. *Phacus triqueter* (Ehrenb.), x 500 (Stein).

PLATE XVII

1. *Phacus suecica* Lemmermann, x 500 (Lemmermann).
2. *Phacus longicauda* (Ehrenb.), x 500 (Lemmermann).
3. *Phacus caudata* Hübner, x 500 (Hübner).
4. *Phacus acuminata* Stokes, x 500 (Stokes).
5. *Phacus brevicaudata* (Klebs), x 500 (Lemmermann).
6. *Phacus stokesii* Lemmermann, x 500 (Lemmermann).
7. *Phacus hispidula* (Eichw.), x 500 (Stein).
8. *Phacus monilata* Stokes, x 500 (Stokes).
9. *Phacus pyrum* (Ehrenb.), x 500 (Lemmermann).
10. *Phacus nordstedtii* Lemmermann, x 500 (Lemmermann).
11. *Phacus setosa* Francé, x 500 (Francé).
12. *Phacus striata* Francé, x 500 (Francé).
13. *Phacus oscillans* Klebs, x 500 (Klebs).
14. *Phacus parvula* Klebs, x 500 (Lemmermann).
15. *Phacus clavata* Dangeard, x 500 (Lemmermann).
16. *Phacus pusilla* Lemmermann, x 500 (Hübner).
17. *Phacus dangeardii* Lemmermann, x 500 (Dangeard).

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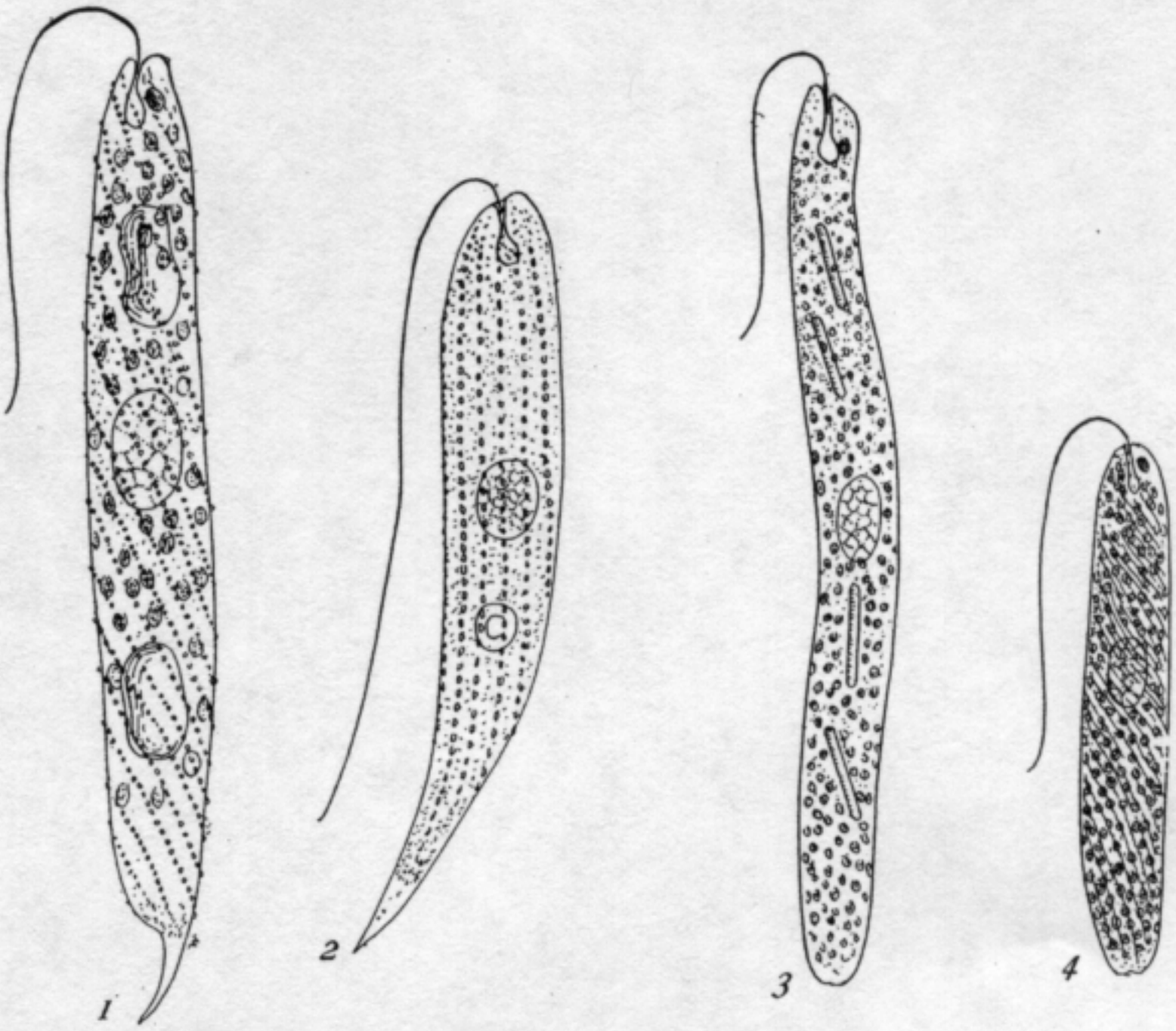

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