

# Some Chaetoceras and Peragallia of Japan.

PLATE III—IV.

By

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Genus I. Chaetoceras Ehb.

Subgen. I. Phaeoceras Gran.

Section 1. **Atlanticæ** Ostf.

1. *C. atlanticum* Cleve. Pl. IV, Figs. 56–63.

Cleve Arctic Sea, 1873 *a*, p. 11, Pl. II, Fig. 8 *a, b*; Gran., Diat., 1905, p. 64, Fig. 74.—*C. dispar* Castr., 1886, Report, p. 76, t. 8, f. 6.—*C. compactum* Schütt, Chæt. und Perag., 1895, p. 46, f. 23.

Loc. in Jap : Prov. Tosa; 40 miles off Shinshirijima (Kurile : Lat.  $46^{\circ} 10' N$ ; Long.  $151^{\circ} 40' E$ ).

Among our specimens represented in Pl. IV. Figs. 56–63, there are some such as those figured in Figs. 59 and 61–62, which resemble in the forms of the cells very much like *C. skeleton*; but the direction of spines are different from that of those of the latter species.—Only I am not sure whether the specimen shown in Fig. 63 is the present species or *C. neapolitanum* Schröd.

The specimens figured measure as follows : in Figs. 56 and 61, breadth=17 and 35  $\mu$ , length=10 and 7.5  $\mu$ , height of foramen 11 and 12  $\mu$ , length of horn-root 5 and 7.5  $\mu$ , respectively ; in Fig. 57, breadth and length=10 and 20  $\mu$ ; in Fig. 58, breadth=22.5–24  $\mu$ ; in Fig. 60, thickness=15  $\mu$ .

Section 2. **Boreales** Ostf.

2. *C. densum* Cleve. Pl. III, Figs. 16–17.

Cleve Season Distr., 1901. p. 299; Gran., Diat., 1905, p. 67, Fig. 79.—*C. boreale* v. *Brightwelli* Cleve, Arctic sea, 1873 *a*, t.

2, f. 7 *b-d*.—*C. boreale* v. *densa* Cleve Treatise, 1897 *a*, p. 20, Pl. I, Figs. 3–4.

Loc. in Jap.: Tateyama in Prov. Boshyu (June, 2, 1906).

Breadth and length of cell,  $7.5\ \mu$  and  $20\ \mu$ , as measured on the specimen shown in Fig. 16.

3. *C. boreale* Bail.

Pl. III, Figs. 18–20.

Cleve, Treatise, 1897 *a*, p. 20, Pl. I, f. 1; Gran., Diat., 1905, p. 73, Fig. 87.—*C. boreale* v. *Brightwelli* Cleve Arctic Sea, 1873 *a*, p. 12, Pl. II, Fig. 7 *a* (not *b-e*); Cleve, Treatise, 1897 *a*, p. 20, Pl. I, f. 2.

Loc. in Jap.: Tateyama in Prov. Boshyu (June, 2, 1906).

The specimens figured measure: in Fig. 20, breadth =  $37\ \mu$ , length =  $30-45\ \mu$ ; in Fig. 19, thickness =  $26-30\ \mu$ ; thickness of spine in Fig. 20,  $3.7\ \mu$ .

4. *C. coarctatum* Lauder.

Pl. III, Figs 25–32.

Lauder, Hongkong, 1864, p. 79, Pl. VIII, Fig. 8 *a-b*; Cleve, Java, 1873, p. 9, Pl. II, Fig. 10 *a-c*; Cleve, Treatise, 1897 *a*, p. 20; Gran., Diat., 1905, p. 68, Fig. 80.—*C. boreale* v. *rudis* Cleve Treatise, 1897 *a*, p. 20, Pl. I, f. 5.—*C. rudis* Cleve, Season. Distr., 1901, p. 308.

Our specimens exactly resemble to those which are illustrated in Cleve's Diat. found on the surface of the Sea of Java Pl. II., Fig. 10 *a-c* and the complete specimen has not yet been found. Mr. YENDO told me that he found a vorticella attached on the body of the plant of this species, whenever he examined it, and I also found it to be the case. At present we do not know what relation exists between the plant and the vorticella.

Loc. in Jap.: Prov. Tosa; Prov. Shima (Aug., 2, 1904); Shirahama in Prov. Boshyu (May, 1905); Misaki in Prov. Sagami (YENDO).

Breadth, length and thickness of body measure  $30-35\ \mu$ ,  $45\ 50\ \mu$  and  $20-27\ \mu$  respectively in the specimen shown in Fig. 29.

5. *C. criophilum* Castr.

Pl. III, Figs. 33–37.

Castr. Challenger Rep., 1886, p. 78 with figure; Jörgensen, Protistenplankt. 1901, p. 20; Gran., Diat., 1905, p. 71, Fig. 85.

Loc. in Jap.: 40 miles off the coast of Shinshirijima (Kurile).

The specimens figured measure: in Fig. 33, breadth= $19\mu$ , length= $27\mu$ ; in Fig. 37, diameter= $19\mu$ ; diameter rarely attains the length of  $40\mu$ .

6. *C. peruvianum* Btw. Pl. IV, Figs. 67–75.

Btw., Microsc. Journ. 1856, p. 107, Pl. VII, f. 16–18; Ostf., Mar. Pl. Diat. p. 238; Gran., Diat., p. 70, Fig. 84; etc.

Loc. in Jap.: Prov. Tosa; Prov. Shima (Feb., 3, 1904); Shirahama in Prov. Boshyu (May, 1904).

In the specimen shown in Fig. 75 which has longer cell, the breadth of cell measures  $17\mu$ .

7. *C. rostratum* Lauder. Pl. III, Fig. 15 a.

Lauder, Hongkong, 1864, p. 79, Pl. VIII, Fig. 10.

Loc. in Jap.: Cape Goza in Prov. Shima (Aug., 2, 1904).

Length and breadth of cell  $30\mu$  and  $20\mu$ , as measured on the specimen represented in Fig. 15 a.

8. *C. denticulatum* Lauder. Pl. IV, Fig. 66.

Lauder, Hongkong, 1864, p. 79, Pl. VIII, Fig. 9.—Schröder, Warm. Meere, 1906, p. 349, Fig. 14 a.

Loc. in Jap.: Cape Goza in Prov. Shima (Aug., 2, 1904).

Length and breadth of cell,  $32\mu$  and  $15\mu$ , as measured on the specimen represented in Fig. 66, and  $42\mu$  and  $20\mu$  in that of Fig. 66 a. Valve measures  $13\mu \times 17\mu$  in the specimens shown in Fig. 16 b.

The position of teeth in the narrower and broader form of the present species is misrepresented in the figure given by Schröder, l. c. Fig. 14 a and b. That represented by Lauder l. c. Fig. 9 c is correct. Our figure 66 shows the terminal cell on the anterior end of a chain, while Fig. 66 a, that on the posterior.

9. *C. nanodenticulatum* Sp. nov.

*C. denticulatum* Lauder Breitere Form in Schröder, Warm. Meere, 1906, p. 350, f. 14 b.

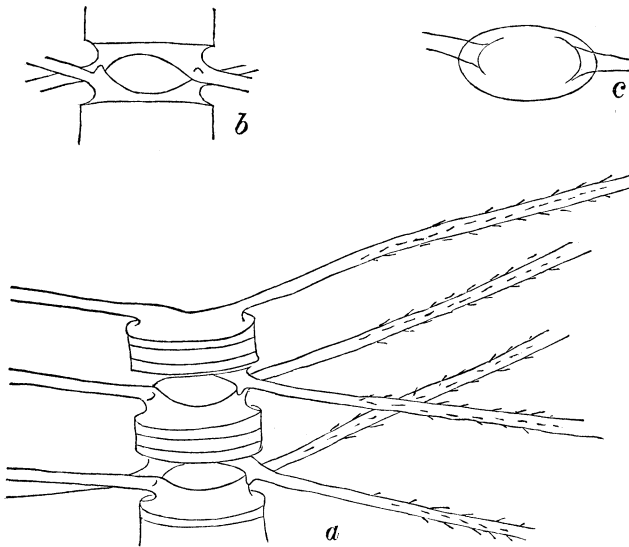
Chain consisting of few cells, straight and not twisted, shorter than broad, length being almost half as broad. Cells oblong

when viewed from the valve, with high mantle and sharp edge between valve and mantle. Valve slightly concave in sagittal longitudinal plane, vaulted in transverse-longitudinal plane. Foramen elliptic-lanceolate. Hoop almost equal to half the length of mantle, not constricted. Horn arising within the corners, with their short roots directed diagonally outward, and straight in their remaining part, provided with coarse spinules. At the junction-point of both posterior horns of every cell, except the lowest one in a chain, there is a minute tooth-like process by which cells are united together.

Loc. in Jap.: Cape Goza in Prov. Shima (Aug., 2, 1904).

Hitherto-known: Hongkong (Schröder).

The present species very much resembles *Ch. boreale* Bail. in general aspect, the difference however being at once manifest in the possession of teeth on posterior horns. It is distinguished from *Ch. denticulatum* Lauder by the form and size of cell and



*C. nanodenticulatum* Sp. nov.

Fig. a: Portion of a chain with terminal cell at the anterior extremity, viewed slightly obliquely,  $\frac{390}{100}$ ; Fig. b: Junction-point of the same,  $\frac{390}{100}$ ; Fig. c: Cell seen from the valve,  $\frac{390}{100}$ .

foramen, length of hoop, as well as by the direction and length of horn-roots. In *Ch. denticulatum* form of cell is cylindrical with almost circular valve and the length is twice as long as or more than the breadth, while in the present species cell is rectangular in broader girdle surface having oblong valve and the length is much shorter than breadth. Again, in the former, foramen is small and vertically rhombic while in the latter it is larger and transversely elliptic-lanceolate.

Root of horn is longer in *Ch. denticulatum* and directed almost vertically, while it is much shorter in *C. nanodenticulatum* and decidedly diagonal. Again, in the former, hoop is a little constricted and is very long and exceeds the half-length of the mantle, while in the latter it is not constricted and is either narrower than or equal as broad as the half-length of the mantle.

Thus, the differences between the two related species are so numerous that one may not take the present species as a mere broader form of *Ch. denticulatum* as Schröder thinks. We can not also consider that these two forms are due to seasonal variations, as it is case in *Ch. decipiens* Cleve, for they occur in the same sample collected both at the same time and locality.

The specimen shown in the annexed figure measures as follows: length and breadth of cell,  $22.5\mu$  and  $45\mu$  respectively; height of the mantle  $15\mu$  and that of hoop  $7.5\mu$ ; thickness of spine  $3.75\mu$ .

## Subgen. II. *Hyalochæte* Gran.

### Section 3. *Dicladia* (Ehr.).

10. *C. Lorenzianum* Grun. Pl. IV, Figs. 38–39.

Cleve Treatise, 1897 a, p. 21, Pl. I, f. 13, 14, 15; Gran., Diat., 1905, p. 76, f. 90.—*C. cellulosum* Lauder, Hongkong, 1864, p. 78, t. 8, f. 12.

Loc. in Jap.: Shirahama in Prov. Boshyu.

Breadth and length in our specimens measure  $27\text{--}35\mu$  and  $20\text{--}35\mu$  respectively. The specimen shown in Fig. 38a measures

11 by  $22\ \mu$  in thickness and breadth respectively. From that figure it will be seen that all the horns stand in sagittal-longitudinal plane.

#### Section 4. *Cylindrica* Ostf.

11. *C. teres* Cleve? Pl. IV, Figs. 53, 54.

Cleve Treatise, 1897 a, p. 22, t. 2, f. 10?; Gran., Diat., 1905, p. 76, Fig. 91?

The specimen before us is too imperfect to determine its specific name.

Loc. in Jap.: Tateyama in Prov. Boshu (June, 2, 1906).

The specimen figured measures  $57.5\ \mu$  in breadth and  $45\ \mu$  in thickness.

#### Section 5. *Compressa* Ostf.

12. *C. compressum* Lauder. Pl. III, Figs. 8–11.

Lauder, Hongkong, 1864, p. 78, Pl. VIII, Fig. 6; Cleve, Java, 1873, p. 78; Ostf., Mar. Pl. Diat., 1902, p. 234, Fig. 12.—*C. Kelleri* Brun (after Ostf. l. c.).—Schröder, Warm. Meere, 1906, p. 350.

Loc. in Jap.: Tateyama in the Prov. Boshu (June, 2, 1906); Cape Goza in Prov. Shima (Aug., 2, 1904).

Endocysts are formed almost in the middle part of cells and have both valves almost equal and smooth.

In 1901 Schmidt for the first time described *Richelia intracellularis* as endoparasite in the cells of *Rhizosolenia styliformis*.<sup>1)</sup> In the sea of the Pacific side of this country I often met with that parasite in the cells of *R. styliformis* (I can not state for the present whether or not the parasite is always found in one and same species).

While pursuing this study I found another case with respect to the parasitism of this filamentous alga. It is not with *Rhizosolenia* but with *Chaetoceras compressum* Lauder. I met

<sup>1)</sup> *Richelia intracellularis* Schm. in Ostf. and Schm., 1901, Adenbugten, p. 146, f. 2; also in Hedwigia, Bd. XL, 1901, p. 112 with figure.

with a chain of *Ch. compressum* in which four filaments of *R. intracellularis* were observed, each being inserted between two cells. I thought that it was accidentally so placed; but when I met with another chain of the species similarly infested in the same sample, I came to consider that there should exist some relations between the two organisms. Though there are plenty of chains of *Ch. compressum*, they are not all infested with this parasite nor does every foramen of each chain; for there must be certain coincidence between the thickness of the parasitic filament and size of foramen of the host.

As far as we know we must conclude that *R. intracellularis* is either endo- or ecto-parasite which has probably certain relations of nutrition with diatomaceous organisms such as *Rhizosolenia* and *Ch. compressum* and perhaps still other ones.

In our specimens represented in Figs. 8–10, breadth, length and thickness of cells of *Chaetoceras* measure  $5\mu$ ,  $5\mu$  and  $2.5\mu$  respectively; in Fig. 11, breadth,  $22\mu$ .

#### Section 6. **Protuberantia** Ostf.

13. *C. didymum* Ehr. v. *genuina* Gran. Pl. IV, Fig. 48 a–c.

Gran, Diat., 1905, p. 79, Fig. 94. ? Btw., Micr. Journ. Vol. IV, 1856, Pl. VII, Figs. 3–7.

The specimens before us are perhaps young ones which have close resemblance to the figures given in Btw. l. c. Pl. VII, Figs. 3–7.

Loc. in Jap.: Prov. Tosa.

Breadth and length measure  $20\mu$  and  $7.5\mu$  respectively in the specimen shown in Fig. 48 b.

14. *C. didymum* v. *anglica* (Grun.) Gran. Pl. IV, Figs. 44–47.

Gran, Diat., 1905, p. 80, Fig. 95.—*C. longicrura* (Cl.) Ostf. u. Schm. Red Sea, p. 154; Ostf. Færøes, 1903, p. 576.—*C. didymum* var. *longicruris* Cleve, Treatise, 1897 a, p. 21, Pl. I, Figs. 11, 17.

Loc. in Jap.: Cape Goza in Prov. Shima (Aug., 3, 1904; Feb., 3, 1904).

Breadth and length measure  $10\mu$  and  $5\text{--}14\mu$  respectively in the specimen shown in Fig. 44. The specimen represented in

Fig. 45 *a* measures  $6\ \mu$  in thickness. It will be seen from the figure just mentioned that all the horns stand on sagittal-longitudinal plane.

Section 7. **Constricta** Ostf.

15. *C. constrictum* Gran. Pl. IV, Fig. 64 *a-b*.

Gran, Diat., 1905, p. 80, Fig. 96.—Lemm. Ergebnisse, 1899, p. 385.

Loc. in Jap. : 40 miles off the coast of Shinshirijima (Kurile).

If my identification proves to be correct it seems to me that *C. constrictum* is very difficult to distinguish it from *C. siamense*.

In the specimen represented in Fig. 64 *a*, the breadth and thickness of the body measure  $26\ \mu$  and  $15\ \mu$  respectively, and the height of foramen,  $7.5\ \mu$ .

16. *C. javanicum* Cleve. Pl. IV, Figs. 55 and 55 *a, b*.

Cleve, Java, 1873, p. 10, Pl. II, f. 13 ; Ostf. Mar. Pl. Diat., 1902, p. 236, Figs. 14, 15.

Loc. in Jap. : Cape Goza in Prov. Shima (Aug., 3, 1904) ; Tateyama in Prov. Boshyu (June, 2, 1906).

This species is, as Cleve has already stated, nearly akin to *C. Schüttii* Cl. and *C. affine*, Lauder, but to me it seems not to be identical. In this species, apical horns are more or less acute in divergence and often run almost parallel to each other. The horns which have a characteristic curvature as shown in Figs. 55 *a, b* are thin and turn off toward the ends of chain.

17. *C. Vanheurckii* Gran. ? Pl. III, Figs. 21, 22.

Ostf. Mar. Pl. Diat., 1902, p. 240, Figs. 18, 19. ?

Loc. in Jap. : Shirahama in Prov. Boshyu (May, 1904).

The specimen before us may not belong to the species mentioned, as I was ignorant of the character and number of chromatophores in the present plant.

Section 8. **Stenocincta** Ostf.

18. *C. affine* Lauder. Pl. III, Figs. 4, 5.

Lauder, Hongkong, 1864, p. 68, Pl. VIII, f. 5.



This species, as it seems to me from our specimens, is perhaps the same as *C. Schüttii* Cleve, as Prof. Gran remarks in his Diatomaceæ, 1905, p. 81. I have found that all the spines lie on the sagittal-longitudinal plane as is shown in Fig. 4 *a*. As I have mentioned under *C. Ralfsii* I have found that the terminal horn of this species is similarly constructed as in *C. Ralfsii*; that is, it is quadrangular and has very minute dot-like teeth along the ridges.

Breadth of the cell measures  $26\ \mu$  in the specimen shown in Fig. 4, and the thickness and breadth,  $11\ \mu$  and  $33\ \mu$  respectively in that shown in Fig. 4 *a*.

Loc. in Jap.: Tateyama in the Prov. Boshyu (June, 2, 1906); Shinoshima in Prov. Owari (Aug., 1906); Cape Goza in Prov. Shima (Aug., 2, 1904).

19. *C. Ralfsii* Cleve in Schröder, 1906, p. 352, f. 16; Cleve Diat. of Java, 1873, p. 10, Pl. III, Fig. 15.?

Loc. in Jap.: Cape Goza in Prov. Shima (Aug., 2, 1904); Enoshima in Prov. Sagami (Schröder).

Schröder illustrates in his "Beitr. z. Kenntnis des Phytoplanktons warmer Meere," p. 352, f. 16 *Chaetoceras Ralfsii* Cleve, (I have no facility to refer to p. 251 where the explanation of this species may perhaps be given) which much differs from the original figure given by Cleve in his "Examination of Diatoms found on the Surface of the Sea of Java" p. 10, Pl. III, Fig. 15. I have identified my material after Schröder's illustration, and if his figure really represents *Ch. Ralfsii*, the necessary conclusion might be that Cleve's *Ch. Ralfsii* is nothing but *Ch. affini* Lauder.

Struck by Schröder's representation I entered into comparative study of terminal horns of *Ch. Ralfsii* and *Ch. affini* and found that both are similarly constructed as are shown in our Figs. 4 *b* and 6 *c*. This character is at variance with Cleve's remark which says "this species (*Ch. Ralfsii*) resembles *Ch. affini* Lauder, but the awns are dissimilar." The possession of dot-like spinules on terminal horns being common to both species, the only difference between those of the species related is the degree of curvature.

The distinctions between *Ch. Ralfsii* and *Ch. affine* are found, besides the difference just stated above, in the length of cells and hoops and in the curvature of remaining horns. In *Ch. affine* hoops are very narrow and constricted while in *Ch. Ralfsii* they are very wide with often insignificant constriction and cells are shorter in the former, while much longer in the latter. Horns, again, are straight in the former while in the latter they are much curved; and the horns of *Ch. Ralfsii* are seen to lie on one and same plane as viewed from the broader girdle surface. The terminal horns of *Ch. affine* are usually very widely parted but are not without the case when they are put in somewhat acute angle as is shown in Cleve's figure as well as in our Fig. 6. Thus, if Schröder's illustration really represents *Ch. Ralfsii* and my comparative study is correct, we might conclude that Cleve has described a form of *Ch. affine* under the name of *Ch. Ralfsii* and then Schröder's *Ch. Ralfsii* must stand as that species which has been truly represented for the first time.

Length and breadth of cells shown in the figure measure  $26\ \mu$  and  $10\ \mu$  respectively.

20. *C. paradoxum* Cleve.

Pl. III, Figs. 12–15.

Cleve Java, 1873, p. 10, Pl. III, Fig. 16 a; Ostf., Færoes, 1903, p. 573.

Loc. in Jap.: Cape Goza in Prov. Shima (Aug., 1904).

The specimens figured measure: in Fig. 12, thickness =  $12\ \mu$ ; in Fig. 14, breadth and thickness  $26\ \mu$  and  $17\ \mu$  respectively; in Fig. 15, breadth =  $17\text{--}20\ \mu$ .

#### Section 9. **Lacinosa** Ostf.

is arcuate with numerous longer spines, and the secondary valve is humped with shorter spines on the hump.

Loc. in Jap.: Cape Goza in Prov. Shima (Aug., 3, 1904).

The specimens figured measure: in Fig. 40, breadth and length,  $10\ \mu$  and  $10\text{--}12\ \mu$ ; in Fig. 43,  $27.5\ \mu$  and  $10\text{--}12\ \mu$  respectively.

#### Section 10. **Diversa** Ostf.

22. *C. læve* Leud.—Fortm. Pl. III, Figs. 23–24.

Ostf., Mar. Pl. Diat., 1902, p. 237, Fig. 16; Id. Færøes, 1903, p. 576; Schröder, 1906, Warm. Meere, p. 351.

Loc. in Jap.: Cape Goza in Prov. Shima (Aug., 3, 1904).

Breadth as well as length of the cell in the specimen represented in Fig. 23 measure  $10\ \mu$  and  $7.5\ \mu$  respectively.

23. *C. furca* Cleve var. *macroceras* Schröder. Pl. III, Fig. 7. Schröder, 1906, Warm. Meere, p. 351, Fig. 15.

Loc. in Jap.: Tateyama in Prov. Boshyu (June, 2, 1906);

Cape Goza in Prov. Shima (Aug., 3, 1904); Prov. Tosa.

Breadth measures  $12\ \mu$  in the specimen shown in Fig. 7.

As I have not seen any European specimen of this species, I here refer my material to the present var. after the opinion of Schröder.

#### Section 11. **Brevicatenata** Gran.

24. *C. crinitum* Schütt. Pl. III, Figs. 1–3.

Schütt, Chaet. u. Perag., 1895, p. 41, Pl. IV, f. 12, Pl. V, f. 12 *b–d*; Gran, Diat., 1905, p. 89, f. 113.

Loc. in Jap.: Tateyama in Prov. Boshyu (June, 2, 1906).

Breadth and thickness measure  $17\ \mu$  and  $15\ \mu$  respectively in the specimens represented in Figs. 1–3.

#### Section 12. **Curviseta** Ostf.

25. *C. secundum* Cleve. Pl. IV, Figs. 49–52.

Cleve, Java, 1873 *b*, p. 10, Pl. II, Fig. 14; Ostf. Mar. Pl. Diat., 1902, p. 239.—*C. curvisetum* Cleve Malay Arch., 1902, p. 18 and p. 55 (after Ostf.).

According to Ostenfeld's view (Mar. Pl. Diat., p. 239) I have here referred our plant to *C. secundum*. I do not know whether all the plants having the name of *C. secundum* Cleve is identical with *C. curvisetum* Cleve mentioned in Gran's Diatomaceæ p. 91.

Loc. in Jap. : Prov. Boshyu (May, 1906).

Breadth and thickness measure  $11\ \mu$  and  $7.5\ \mu$  respectively in the specimens represented in Figs. 49, 51 and 52 ; and in Fig. 50, breadth,  $25\ \mu$ .

26. *C. debile* Cleve.

Pl. IV, Figs. 76, 77.

Gran, Diat., 1905, p. 92, Fig. 117 *a-b*.—*C. vermiculus* Schütt, Chæt. u. Perag., 1895, p. 39, f. 7 *a-c*.

Loc. in Jap. : 40 miles off the coast of Shinshirijima (Kurile).

Breadth measures  $20-27\ \mu$  in the specimen shown in Fig. 76 and thickness,  $7.5\ \mu$  in that figured in Fig. 77.

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## Genus II. Peragallia Schütt.

1. *P. meridiana* Schütt.

Pl. VI, Fig. 65.

Schütt, Chaet. u. Perag., 1895, p. 48, Taf. 5, Fig. 28, *a-b*.—*P. tropica* Schütt in Engler u. Prantl, Pflanzenfam, Bacillariaceæ, p. 86, Fig. 142.

In our specimens, cells are united into a straight chain instead of being solitary as it is shown by Schütt, and have lanceolate foramen. Chromatophores are small and fusiform in shape, densely arranged in somewhat radiate manner.

Loc. in Jap. : Prov. Tosa ; Shirahama in the Prov. Boshyu (May, 1906).

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## Explanation of Figures in Plate III-IV.

### PLATE III.

- Figs. 1- 3. *Chaetoceros crinitum* Schütt. (Tateyama in Prov. Boshyu).
1. Chain seen from the broader girdle-surface,  $\frac{600}{1}$ .
  2. Same seen from the narrower girdle surface,  $\frac{600}{1}$ .
  3. Valve seen from above,  $\frac{600}{1}$ .
- Figs. 4- 6. *C. affine* Lauder.
4. Portion of a chain seen from the broader girdle-surface,  $\frac{390}{1}$ . (Tateyama).
  - 4 a. Valvular view of another specimen,  $\frac{390}{1}$ . (Shinoshima, in Prov. Owari).
  - 4 b. Portion of the terminal horn, showing dot-like teeth, *a* represents the proximal end,  $\frac{1560}{1}$ . (Cape Goza).
  - 4 c. Portion of cells,  $\frac{925}{1}$ . ( „ „ ).
  5. Another specimen bearing endocysts,  $\frac{390}{1}$ . (Shinoshima, Aug., 2, 1904).
  6. Portion of chain resembling Cleve's *C. Ralfsii*, shown in Cleve's Diat. Java, fig. 15,  $\frac{390}{1}$ . (Cape Goza).
  - 6 b. Portion of cells showing constriction of hoops at *b, b*, but not at *a, a*,  $\frac{390}{1}$ . (Cape Goza).
  - 6 c. Portion of the teminal horn, *a* represents the proximal end,  $\frac{1560}{1}$ . (Cape Goza).
- Fig. 7. Portion of a chain of *C. furca* Cleve var. *macroceras* Schröder. (Tateyama).
- Figs. 8-11. *C. compressa* Lauder.
8. Chain seen from the broader girdle-surface,  $\frac{600}{1}$ . (Tateyama).
  - 8 a. Portion of chain having endocysts,  $\frac{1080}{1}$ . (Cape Goza, Aug., 2, 1904).
  9. The same seen from the narrower girdle surface,  $\frac{600}{1}$ . (Tateyama).
  10. Valvular view of the same,  $\frac{600}{1}$ . ( „ „ ).
  11. Another specimen, highly magd. (Cape Goza).
  - 11 a. One of chain infested by *Richelia intracellularis*,  $\frac{390}{1}$ . (Cape Goza).
  - 11 b, c. 2 filaments of *Richelia intracellularis*,  $\frac{1080}{1}$ . ( „ „ ).

- Figs. 12–15. *C. paradoxum* Cleve. (Cape Goza).  
 12. Complete chain seen from the narrower girdle-surface,  $\frac{390}{1}$ .  
 13. Valvular view of another specimen,  $\frac{390}{1}$ .  
 14. Portion of a chain consisting of thicker and shorter cells,  $\frac{390}{1}$ .  
 15. Portion of a chain of still another specimen seen from the broader girdle-surface,  $\frac{390}{1}$ .  
 15 a. *C. rostratum* Lauder ;  $\frac{360}{1}$ . (Cape Goza).  
 Figs. 16–17. *C. densum* Cleve. (Tateyama).  
 16. Portion of a chain seen from the broader girdle-surface,  $\frac{390}{1}$ .  
 17. Portion of another specimen seen from the narrower girdle-surface,  $\frac{390}{1}$ .  
 Figs. 18–20. *C. boreale* Bail. (Tateyama).  
 18. Portion of a chain viewed from the narrower girdle-surface,  $\frac{390}{1}$ .  
 19. Valvular view of another specimen,  $\frac{220}{1}$ .  
 20. Portion of chain of still another specimen seen from the broader girdle-surface ; to the left, a cross-section of a horn,  $\frac{220}{1}$ .  
 Figs. 21–22. *C. Vanheurckii* Gran ? (Shirahama in Prov. Boshyu).  
 21. Portion of a chain,  $\frac{220}{1}$ .  
 22. Part of the same magnified,  $\frac{600}{1}$ .  
 Figs. 23–24. Two different forms of *C. læve* Leud.—Fortm.,  $\frac{390}{1}$ .  
 (Cape Goza in Prov. Shima).  
 Figs. 25–32. *C. coarctatum* Lauder.  
 25. Terminal horn of the cell of upper end of a chain,  $\frac{220}{1}$ .  
 (Shirahama in Prov. Boshyu).  
 26. Terminal horn of the cell of lower end of a chain shown in Fig. 27,  $\frac{390}{1}$ . (Shirahama in Prov. Boshyu).  
 27. Portion of an incomplete chain,  $\frac{91}{1}$ . („ „ „ „ ).  
 28. Horn marked s in Fig. 27,  $\frac{390}{1}$ , („ „ „ „ ).  
 29. Broader girdle-surface of a portion of the chain shown in Fig. 27,  $\frac{390}{1}$ . (Shirahama in Prov. Boshyu).  
 30. Piece of a chain seen from below ; a, a, terminal horns of the cell of upper end,  $\frac{91}{1}$ . (Prov. Tosa).  
 31. Cell of the lower end of another chain seen from above,  $\frac{175}{1}$ . (Prov. Tosa).  
 32. Valvular view of a cell of still another specimen,  $\frac{390}{1}$ . („ „).  
 Figs. 33–37. *C. criophyllum* Castr. (40 miles off Shinshirijima).



- 33-34. Different views of different specimens,  $\frac{390}{1}$   
 35. One of the cells of a chain set free,  $\frac{390}{1}$ .  
 36. One of the cells of another chain many-times divided,  $\frac{390}{1}$ .  
 37. Detached cell seen from the lower valve,  $\frac{390}{1}$

## PLATE IV.

- Figs. 38-39. *C. Lorenzianum* Grun.  
 38. Portion of a chain,  $\frac{390}{1}$ . (Tateyama).  
 38 a. Valvular view of a cell of another specimen. (Cape Goza).  
 39. Complete specimen,  $\frac{390}{1}$ ; portion of terminal horn and of one of the remaining horns, slightly magnified. (Tateyama).  
 Figs. 40-43. *C. distans* Cleve. (Cape Goza).  
 40. Complete chain just forming an endocyst,  $\frac{390}{1}$ .  
 41. Portion of a fructified chain,  $\frac{390}{1}$ .  
 42. Cross-section of a cell, viewed in slightly oblique direction,  $\frac{390}{1}$ .  
 43. Another specimen having broader cells,  $\frac{390}{1}$ .  
 43 a. Portion of a fructified chain having broader cells,  $\frac{390}{1}$ .  
 Figs. 44-47. *C. didymum* Ehr. var. *anglica* (Grun.) Gran.  
 44. Portion of a chain,  $\frac{390}{1}$ . (Cape Goza).  
 45. Central protuberances seen a little obliquely,  $\frac{390}{1}$ . (., , ).  
 45 a. Valvular view of a cell of another specimen,  $\frac{390}{1}$ . (., , ).  
 46. Still another specimen seen from the narrower girdle-surface in a slightly oblique manner,  $\frac{390}{1}$ . (Cape Goza).  
 47. Portion of a chain. (40 miles off Shinshirijima).  
 Figs. 48 a-c. 3 different younger cells of *C. didymum* Ehr. var. *genuina* Gran,  $\frac{600}{1}$ . (Prov. Tosa).  
 Figs. 49-52. *C. secundum* Cleve. (Tateyama).  
 49. Portion of a spiral chain,  $\frac{140}{1}$ .  
 50. Portion of another specimen seen from the outer side of spiral chain,  $\frac{390}{1}$ .  
 51. Portion of still another specimen seen from the outer side of spiral chain; cells are just dividing,  $\frac{390}{1}$ .  
 52. Valvular view of one of the cells of the specimen shown in Fig. 51,  $\frac{390}{1}$ .  
 Figs. 53-54. *C. teres* Cleve? (Tateyama).  
 53. Valvular view of a cell of the chain shown in Fig. 54,  $\frac{390}{1}$ .

54. Portion of a chain,  $\frac{390}{1}$ .
- Fig. 55. Portion of a chain of *C. javanicum* Cleve,  $\frac{390}{1}$ ; (Tateyama).  
*f*, indicates the characteristic flexure of the horn.
- 55 *a, b*. Two different valvular views,  $\frac{390}{1}$ ; *f*, indicates the characteristic flexure. (Cape Goza).
- Figs. 56–63. *C. atlanticum* Cleve.
- 56–57, 61–62. Four different chains showing different lengths of cells and directions of horns,  $\frac{390}{1}$ . (Prov. Tosa).
58. Portion of a chain having terminal horns,  $\frac{320}{1}$ .  
 (40 miles off Shinshirijima).
59. Portion of another chain showing different lengths of cells,  $\frac{390}{1}$ . (40 miles off Shinshirijima).
60. Valve of the specimen shown in Fig. 59 viewed slightly obliquely,  $\frac{390}{1}$ .
63. *C. neapolitana* Schröder?  $\frac{600}{1}$ . ( „ „ „ „ ).
- Figs. 64 *a*. *C. constrictum* Gran, seen from the broader girdle-surface,  $\frac{390}{1}$ . (40 miles off Shinshirijima).
- 64 *b*. Another specimen seen from the narrower surface,  $\frac{600}{1}$ .  
 (40 miles off Shinshirijima).
- Fig. 65. Portion of a *chained* specimen of *Peragallia meridiana* Schütt,  $\frac{390}{1}$ . (Prov. Tosa).
- Fig. 66. Portion of a chain of *Chaetoceras denticulatum* Lauder showing the anterior terminal cell,  $\frac{600}{1}$ . (Cape Goza).
- 66 *a*. Another chain showing the posterior terminal cell,  $\frac{600}{1}$ . (Cape Goza).
- 66 *b*. Cell seen from the valvular side of another specimen,  $\frac{390}{1}$ . (Cape Goza).
- Figs. 67–75. *C. peruvianum* Btw.
67. *C. peruvianum* f. *robusta*,  $\frac{600}{1}$ . (Prov. Tosa).
- 67 *a*. Portion of spine,  $\frac{600}{1}$ .
68. Specimen resembling *C. boreale* Lauder,  $\frac{390}{1}$ . (Prov. Shima).
- 69–73, 75. Different forms in different sizes; Figs. 69–70,  $\frac{91}{1}$ ; Figs. 71–73,  $\frac{600}{1}$ ; Fig. 75,  $\frac{390}{1}$ . (Prov. Tosa).
74. Upper valve seen a little obliquely,  $\frac{600}{1}$ . ( „ „ „ ).
- Figs. 76–77. *C. debile* Cleve. (40 miles off Shinshirijima).
76. Portion of the spiral chain,  $\frac{600}{1}$ .
77. Portion of the chain of another specimen seen from the narrower girdle-surface,  $\frac{390}{1}$ .