Zoologischer Anzeiger

herausgegeben

von Prof. **Eugen Korschelt** in Marburg.

Zugleich

Organ der Deutschen Zoologischen Gesellschaft.

Bibliographia zoologica

bearbeitet von Dr. **H. H. Field** (Concilium bibliographicum) in Zürich.

Verlag von Wilhelm Engelmann in Leipzig.

XXXII. Band. 1. Oktober 1907. Nr. 7.

Inhalt:

I. Wissenschaftliche Mitteilungen.

1. The plates of Ceratium with a note on the unity of the genus.

By Prof. Charles Atwood Kofoid.

(Zoological Laboratory, University of California, Berkeley.)

(With 8 figures.)

eingeg. 25. Juni 1907.

In the course of the preparation of an account of this genus as it occurs in the plankton of the Pacific off San Diego I have had occasion to determine the plates of the theca and find my results at variance with those hitherto reported. This has led me to verify, in most particulars, my conclusions here presented, on a large number of individuals, representing at least sixteen species of *Ceratium* including representatives of the genera *Ceratium* sensu stricta, *Amphiceratium*, *Biceratium* and *Poroceratium* of Vanhoeffen (1896) and has therefore enabled me to reach conclusions regarding the validity of this proposed dismemberment of the genus *Ceratium*.

In agreement with Stein (1883), Bütschli (1883—1887) and Schütt (1895) as opposed to Klebs (1884) I regard the plates of the Dinoflagellates as structurally stable features, subject, of course, to variation and abnormalities, and even to irregularity in a few species, but of sufficient constancy to afford a most satisfactory basis for classification, a basis, moreover, now widely adopted as a criterion for generic distinction among the Dinoflagellata.

As Schütt (1895) has so well shown, the superficial lists, even the primary ones, are in no way a safe criterion for the analysis of the thecal structure. This can be accurately determined only by following the sutures. These, however, are obscure, and are often only dimly suggested by vaguely outlined overlapping margins of the plates that appear best upon deep focus on the thecal wall. Prolonged treatment in warm alkalis does not always bring about separation of the plates along the suture lines though it is of great assistance in resolving the structure.

Actual separation of the plates in situ is the only safe guide to an analysis of the thecal wall, but a failure to cause separation under treatment does not afford a valid basis to deny the existence of a suture, since it may be merely the result of the condition in which the material is found at the time of examination. I am inclined to believe, as a result of many tests, that all reports of three apical plates in *Ceratium* rest upon material imperfectly separated, and that the variation in the splitting of the apical and left antapical horn reported by Klebs (1884) is more a matter of imperfect separation than of a morphological variation in suture lines and number of plates. In other words I have found *Ceratium* far more constant in the matter of sutures and plates than it has been reported to be.

Stein (1883) characterized the genus and distinguished it from *Peridinium*, with which Ehrenberg (1835) had confused it, and from which Claparède and Lachmann (1858—1859) had subsequently separated it on the basis of the horns, by its plates, which he defined as composed »aus 3 Basalien und 3 Frontalien am Vorderleibe, und aus 3 Basalien und einer Endplatte am Hinterleibe«. Bütschli (1883—1887), probably influenced by Klebs' (1884) discovery, regards the theca as composed anteriorly of three equatorial and three (sometimes more) apical plates, and posteriorly by three equatorial and one apical plate. Schütt (1896) regards the »Oberschale« as composed of three intermediate plates and four end plates and the »Unterschale« as made up of three equatorial plates and one end plate. He notes also the presence of several girdle plates.

Entz (1905) was the first investigator to establish the existence of

four apicals. In the case of *C. hirundinella* and *C. candelabrum* he finds four plates in each of the series which he designates as pre-and post-equatorials. He finds but one antapical plate, and adds much to our knowledge of the obscure details of the ventral plate, longitudinal furrow and attachment region.

I shall use the term apical for the anterior series of plates only, and shall designate the series anterior to and contiguous to the girdle as precingular (prec.), and that posterior to and contiguous to it as postcingular (postc.), and the posterior ones as antapicals (antap.). These names are distinctive of the four series and are widely applicable throughout the Dinoflagellates.

The theca of *Ceratium* is composed of four series of plates, two

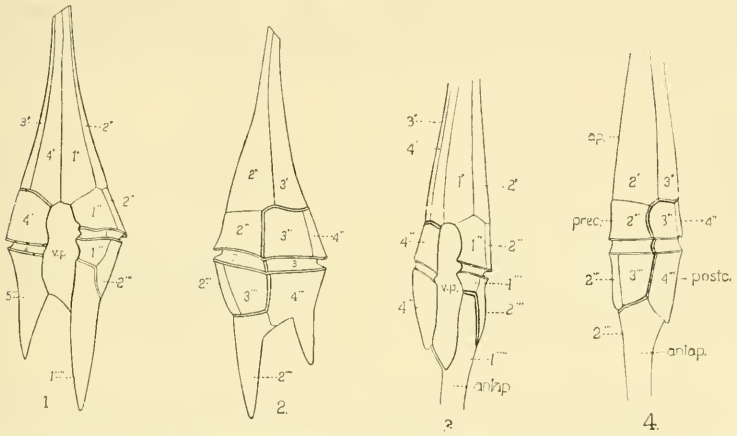

Fig. 1. Ventral view of *Ceratium furca*. × 350. In this and the following figures the apical plates are numbered 1′—4′, the precingulars 1″—5″, the postcingulars 1‴—4‴, the antapicals 1⁗ and 2⁗, and the girdle plates (numbered only in Fig. 1 and 2) 1—4.

Fig. 2. Dorsal view of *C. furca*. × 350.

Fig. 3. Ventral view of *C. fusus*, region of the midbody only. × 530. *ap*, apical series; *prec*, precingular series; *postc*, postcingular series; *antap*, antapical series of plates; *v.p*, ventral plate.

Fig. 4. Dorsal view of *C. fusus*. × 530.

in the epitheca anterior to the girdle, and two posterior to it in the hypotheca, with a series of four narrow trough-like girdle plates between. There is in addition to these the so-called ventral plate (v. p.) which is a thin membranous sheet scarcely comparable with the rest of the thecal wall in structure and not belonging to any of the series, but intercalated on the ventral face in the midventral line extending through both the pre- and postcingular series.

There are always, in all species I have thus far examined on this

point, four apical plates (Fig. 4 *ap* 1′—4′). Plates 1′ and 4′ lie on the ventral surface separated from each other by a midventral suture which rises from near the apex of the ventral plate (Fig. 5). This suture is not always easily seen, more readily, perhaps, in the *C. fusus* group (Fig. 4) than in those of the *C. furca* (Fig. 1) group. It is also less readily separable on treatment with reagents. This probable accounts for the fact that in Stein's (1883) figures of *C. furca* this suture is omitted, while it is given by him for *C. fusus*. The fact that these two plates frequently adhere to each other after the other sutures of the apical series separate has given rise to the earlier statements that *Ceratium* has but three apical plates. These two plates are somewhat more slender than the two on the dorsal side. The sutures which separate the ventral and dorsal pairs lie on the ventro-lateral faces and are consequently less easily followed in many species. These rest posteriorly upon the precingular series of four plates, instead of three as usually reported

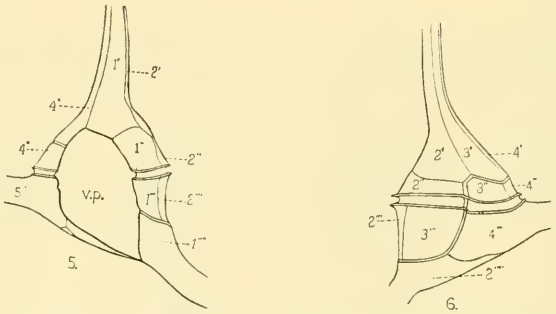

Fig. 5. Ventral view of *C. intermedium*, region of the midbody only. × 350.
Fig. 6. Dorsal view of *C. intermedium*. × 350.

(Fig. 4 *prec* 1″—4″). The line of fission, marked in all the figures by two parallel lines divides these into a right and left pair on the middorsal line. Precingular plates 3″ and 4″ of my nomenclature seem to have been regarded as a single plate by other investigators, except by Entz (1905), by the omission of the suture separating them or failure to note its significance when detected.

The postcingular series (Fig. 4 *poste* 1‴—5‴) is composed of 5 plates, of which two (1‴ and 5‴) are small and lie on the ventral face of the hypotheca. Plate 1‴ is always small and covers a relatively small area posterior to and to the left of the flagellar pore, and generally has a somewhat oblique posterior border. Plate 5‴ forms the ventral face of the right antapical. Its presence is obscured by the fact that the suture which separates it from plate 4‴ lies in the frontal plane passing from the girdle posteriorly along the lateral margin of the hypotheca to

the tip of the right antapical, and thence along its inner (left) margin to the base of the right horn at the upper angle of the oblique postmargin. It is thus in contact dorsally with plate 4‴. Its left median margin is in contact with the ventral plate (*v.p*) and immediately behind the ventral plate it is in contact for a short distance (Fig. 5) with the right tip of the mesad projection of the dorsal antapical (2⁗).

The other plates of the postcingular series, 2‴—4‴, lie on the dorsal side of the epitheca. Plate 2‴ is usually a narrow plate on the left margin of the hypotheca; 3‴ lies to the left of the fission line. Plate 4‴ lies to the right of this line and extends posteriorly to the tip of the right antapical horn, forming its dorsal side only. The right horn thus belongs entirely to the postcingular series of plates.

The left on the other hand is made up of a pair of posterior or antapical plates (1⁗ and 2⁗), one of which (1⁗) is ventral and the other 2⁗) dorsal. The suture line separating these two plates lies in the mid-frontal plane and is frequently marked by a primary list, but is never easily followed as a suture in situ because of its position. The ventral antapical plate (1⁗) is extended anteriorly on the ventral face of the hypotheca till it abuts against postcingulars 1‴ and 2‴ and its mesad margin borders the ventral plate. The dorsal antapical forms not only the dorsal side of the left antapical horn but covers the dorsal face of the posterior part of the hypotheca, meeting postcingular plates 2‴, 3‴ and 4‴. A long narrow shank (Figs. 5 and 6) projects to the right, especially in species of the *C. tripos* group, forming the oblique postmargin between the bases of the antapical horns and meets at its squarish tip the posterior angle of postcingular 5‴ of the right antapical horn. The antapical plates are bounded anteriorly by the fission line to the point of the suture between plates 3‴ and 4‴.

The girdle is composed of four narrow trough-like plates (Figs. 1, 2, 1—4) which part most readily at the fission line in the middorsal suture, and less readily in lateral sutures near those which separate precingulars 1″ and 2″ and 3″ and 4″. This suture and the fact that the left antapical horn is composed of two plates, in so far as I can determine, has not been previously noted. It is one of the sutures most difficult to demonstrate.

The distinction in size between the long left antapical horn and the short right one holds throughout practically all the protean species of this genus. It is least apparent in the long-horned species of the *C. tripos* and *C. macroceros* groups and most pronounced in the *C. fusus* group. This distinction in size is emphasized by the fact that the obliquity of the postmargin brings the base of the right horn anterior to that of the left, and by the fact that its base comes nearer to the girdle

on the lateral margin of the midbody especially in species of the *C. tripos* group (Fig. 5).

This difference in the horns rests upon the fundamental distinction in their morphological relations. The right horn belongs to the postcingular series of plates, and the left to one posterior to this. This constancy in the relations of these horns thus rests upon the constant generic character of the number and relations of the thecal plates.

As shown in the accompanying figures, the several genera proposed by Vanhoeffen (1896) all have the same thecal structure in the matter of the number and relations of the plates in the several series. The differences lie only in the form and proportion of the plates which vary their relations mainly in the extent of their contiguity. *C. fusus* (Fig. 3—4)

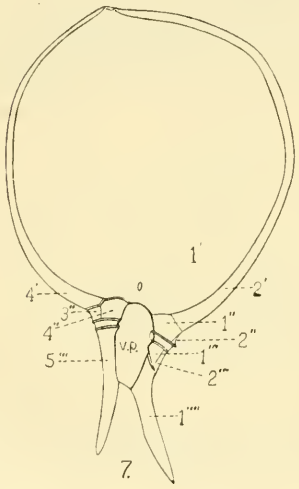

Fig. 7. Ventral view of *C. gravidum*. × 150.

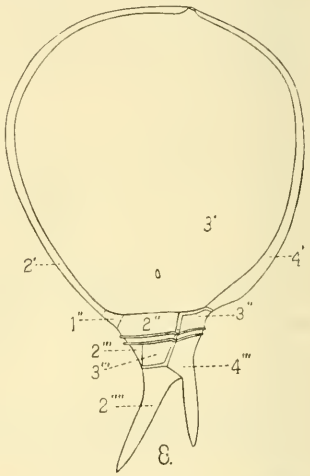

Fig. 8. Dorsal view of *C. gravidum*. × 150.

represents Vanhoeffen's genus *Amphiceratium*, *C. furca* (Figs. 1, 2) his *Biceratium*, *C. gravidum* (Figs. 7, 8) his genus *Poroceratium*, and *C. intermedium* (Figs. 5, 6) his genus *Ceratium* sensu stricta, for which he selected as a representative species, *C. labradoricum* Schütt (= *C. arcticum* Clap. et Lachm.). This is well represented by my figures of the closely related *C. intermedium*.

The fact that the plates of these proposed genera are all identical is in my opinion an imperative reason for rejecting the proposed dismemberment of the genus *Ceratium*. Since the pore which perforates the epitheca of *C. gravidum* is absent in the very closely related *C. praelongum* and is subject to great variation in the degree of its development in *C. gravidum*, even to its suppression, I regard this structure as not affording a basis for the generic distinction of the genus *Poroceratium*.

The mere modifications in the form and proportions of plates, even though they result in the development or suppression of antapical horns, is not, in my opinion, an adequate ground for generic distinctions among the Dinoflagellates. If applied to *Ceratium hirundinella*, for example, it would become necessary to erect new genera for the three, four and five horned varieties or growth forms of this variable species! The unity of the genus *Ceratium* rests upon the well-defined character of the number of its plates and their relations.

Berkeley, June 7, 1907.

Papers Cited.

1883—1887. Bütschli, O., Protozoa. II. Abt. Mastigophora. Bronns Klassen u. Ord. Bd. 1. p. 617—1097. Taf. 39—55.

1834. Ehrenberg, C. C., Dritter Beitrag zur Erkenntniss großer Organisation in der Richtung des kleinsten Raumes. Abh. Kgl. Akad. d. Wiss. zu Berlin. 1883. S. 145—336. 11 Taf.

1905. Entz, G. jr., Beiträge zur Kenntnis der Peridineen. Math.-naturwiss. Ber. aus Ungarn Bd. 20. p. 96—144. 6 Taf. 66 Fig.

1884. Klebs, G., Ein kleiner Beitrag zur Kenntnis der Peridineen. Bot. Zeit. Bd. 42. S. 721—733, 737—745. Taf. 10.

1895. Schütt, F., Die Peridineen. Ergebn. d. Plancton-Expedition. Bd. IV Ma. Teil. I. 170 S. 27 Taf.

1906. —— Peridiniales. Engler und Prantls Nat. Pflanzenfamilien. I. Teil. Abt. b. S. 1—30. 43 Figg.

1883. Stein, Fr., Der Organismus der Infusionsthiere. III. Abth. II. Hälfte. Die Naturgeschichte der Arthrodelen Flagellaten. 30 S. 25 Taf.

1896. Vanhoeffen, E., Das Genus *Ceratium*. Zool. Anz. Bd. 19. S. 133—134.

2. Zur Entwicklungsgeschichte des Sterlets (Acipenser ruthenus).

Von A. Ostroumoff.

IV. Das Gefäßsystem des Kopfes.

eingeg. 23. Juli 1907.

Venen und Lymphgefäße. Die 1. Vene, welche im Kopfe angelegt wird, bezeichne ich als Vena cerebro-spinalis. Dieselbe wird medialwärts von den Cranialnerven und von den Spinalganglien angelegt. Es ist dies dasselbe Gefäß, welches von Raffaele (1892) bei den Selachiern unter dem Namen eines »vaso cerebro-spinale« beschrieben und von mir bei Embryonen von *Pristiurus* (1889) als »vena cardinalis anterior superior« bezeichnet wurde. An ihrem vorderen Ende steht diese Vene in Verbindung mit den Anlagen der »vena cerebralis anterior« und der »vena orbito nasalis«. Letztere bildet um den Augenstiel herum einen ringförmigen Sinus, welcher bei den Selachiern von Raffaele (1892) beschrieben worden ist.

Bei Embryonen des Sterlets mit 50 Somiten findet sich schon eine weitere Vene, die vordere Cardinalvene (s. v. jugularis), welche sich von der Gehörblase bis zu dem Ductus cuvieri erstreckt, medialwärts vom