

JERZY FEDOROWSKI

A REVISION OF THE GENUS *CERATOPHYLLUM* GÜRICH, 1896
(TETRACORALLA)

Abstract. — The present paper is a revision of the genus *Ceratophyllum* Gürich, 1896. It is based on the five specimens from Gürich's original collection and on the specimens assigned to this genus from the Lower Givetian of Skały and the Eifelian of Grzegorzowice, Holy Cross Mountains (Góry Świętokrzyskie). The present author designates here the neotype for the species *Ceratophyllum typus* Gürich, 1896 and chooses it as the type species. A new species *Ceratophyllum eifeliensis* n.sp. is here established and the subspecies *Ceratophyllum typus skalense* Gürich, 1896 described.

INTRODUCTION

The aim of the present study is to define once more in detail the genus *Ceratophyllum* Gürich, 1896, which was never illustrated by its author. The present author has chosen, as a type species, *Ceratophyllum typus*, the first species described by Gürich (1896) in that genus. It comes from what Gürich called "bituminous limestones of Szydłówek" (Szydłówek Stinkkalk), which were considered by that author as Middle Devonian.

According to Czarnocki (The Geological Map of the Holy Cross Region, sheet Kielce, 1939), the age of these limestones is Eifelian. In the present author's opinion, however, they should be regarded rather as Lower Givetian, as they contain the following tetracorals: *Macgeea bathycalyx* (Frech, 1886), *Disphyllum geinitzi* Lang & Smith, 1935, *Metricionaxon schlueteri* Głinski, 1963, *Heliophyllum*, sp. and brachiopod *Cammarophoria? polonica* Gürich, 1896 (according to Dr. G. Biernat's personal communication). All the mentioned are considered Lower Givetian in age.

The coral fauna from bituminous limestones of Szydłówek, mentioned above, is very poor, both numerically and taxonomically. To obtain the corals corresponding to the description of *Ceratophyllum typus* Gürich, the locality was exploited twice by the present author, however, without success.

Five such specimens were found in the remains of Gürich's original collection, presently housed in the Palaeozoological Laboratory, Polish Academy of Sciences, Poznań. The collection in question (marked: Z. Pal. P., Tc) was stored previously in the University of Wrocław, and was nearly completely destroyed during the last war. The remains, without labels and determinations, saved by Prof. Z. Ryziewicz, Director of the Palaeontological Division, University of Wrocław, were offered to Prof. M. Rózkowska, Director of the Palaeozoological Laboratory, Polish Academy of Sciences, Poznań.

The specimens from Gürich's original collection, which can be regarded as coming from Szydłówek only with reservation, as they were without labels, have been completed by material from the Lower Givetian brachiopod shales and from the shales with *Microcyclus* in Skąły. These latter were collected by Prof. M. Rózkowska and the present writer himself. The stratigraphic position of these shales was determined by Sobolev (1904), Rózkowska (1956), Pajchłowa (1957) and others.

The paper has been completed in the Palaeozoological Laboratory, Polish Academy of Sciences, Poznań, under the supervision of Prof. M. Rózkowska. To her, the present author wishes to express his sincere gratitude for putting the material at his disposal, her valuable advice and reading the manuscript.

The photographs were taken by Mr. K. Fryś (Palaeozoological Laboratory, Polish Academy of Sciences, Poznań), to whom thanks are also due.

Suborder **Phillipsastraeacea** Schouppé, 1958
Family **Marisastridae** Rózkowska, 1965
Genus *Ceratophyllum* Gürich, 1896

Type species: Ceratophyllum typus Gürich, 1896; Pl. I, Figs. 1—3, Pl. II Figs. 1—5.

Diagnosis. — Corallites solitary or weakly budding, with major and minor septa usually provided with carinae; dissepimentarium composed of convex dissepiments, arranged semicircularly in longitudinal section; epitheca reaches outspread calycal margin; trabecular asymmetric fans or half-fans; bilateral symmetry very distinct in ontogeny, with counter septum dominating, disappears in ephebic stage.

Remarks. — Gürich (1896) established the genus *Ceratophyllum* for the species described by Frech (1886) as *Cyathophyllum ceratites* Goldfuss, 1826 and for *Ceratophyllum typus* Gürich, 1896, according to Gürich, conspecific with the latter. However, the specimens described by Frech (1886) cannot be identified with *Ceratophyllum*, as, in the majority, they are the representatives of the genera *Disphyllum* and *Macgeea*. The only exception seems to be the specimen illustrated by Frech (1886) on Pl. 5,

Fig. 4, which is close to *Ceratophyllum* in the morphology of its calyx, with a broad, outspread margin and carinate septa.

Out of the forms included to *Ceratophyllum* by Gürich himself (1896), only the subspecies *Ceratophyllum typus skalense* Gürich, shows the characters diagnostic for the genus. The remaining species should be assigned to the other genera and are not considered in the present paper.

In the present author's opinion, to the genus *Ceratophyllum* can be assigned some solitary corals of the genus *Spinophyllum*, established by Wedekind (1921, pp. 5-6), i.e. *S. spongiosum* Wdkd. (1921, p. 6, Fig. 2) and *S. conicum* Kettnerova, 1932 (pp. 55-56, Fig. 41). Moreover, the genus *Glossophyllum* Wedekind, 1924, especially *G. dohmi* Wdkd., 1924 and *G. salmense* Wdkd., 1924, may be the synonym of *Ceratophyllum*. The latter opinion was expressed also by Stumm (1949) and Rózkowska (1954).

In its morphology and ontogeny, *Ceratophyllum* is close to the genus *Macgeea* Webster, 1889, from which it differs mainly in the lack of the horse-shoes and the symmetric trabecular fans.

In view of the extremely large convergencies in this group of corals, which were observed by the present writer, their taxonomical range cannot be definitely decided, because for this purpose, the ontogeny and microstructure are very important. These, however, were not considered by the authors mentioned.

To the genus *Ceratophyllum* were assigned the following species, which mostly do not belong:

1. *Ceratophyllum? ceratites* (Goldfuss); from several specimens, reported by Ma (1937, Pl. 4, Figs. 4-6), not one should be assigned to this genus.

2. *Ceratophyllum* Gürich, 1896; in the revision of the families and genera of Devonian corals, Stumm (1949, Pl. 8) characterizes this genus on the base of the holotypes of *Ceratophyllum ceratites* Goldfuss, 1826, *Glossophyllum dohmi* Wdkd., 1924 and on the base of one of the Ma's drawings (1937). The possibility of the assignment of those specimens to the genus *Ceratophyllum* was discussed above.

3. *Ceratophyllum* sp.; under this name, Wang (1950, Pl. 9, Fig. 74 a-b) presents a specimen with a different structure, which does not correspond to *Ceratophyllum* Gürich, 1896.

4. *Ceratophyllum typus* Gürich, 1896; Rózkowska (1954, Figs. 14-17) assigned to this species the specimens from Eifelian of Grzegorzowice (Holy Cross Mountains), which should be included within *Ceratophyllum*, however, are not conspecific with *C. typus*, and are described in the present paper under the new specific name *C. eifeliensis* n.sp.

5. *Ceratophyllum typus* Gürich, 1896; Soshkina (1962, p. 330, Pl. 6, Fig. 2 a-b) illustrated specimens, corresponding neither to that genus, nor to that species.

Ceratophyllum typus typus Gürich, 1896

(Pl. I, Figs. 1-3; Pl. II, Figs. 1-5)

Neotype: Specimen Z. Pal. P. Tc 1/1, from Gürich's collection; Pl. I, Fig. 1 a-b.*Type horizon*: Bituminous limestones of Szydłówek (after Gürich), Lower Givetian.*Type locality*: Szydłówek, Holy Cross Mountains (after Gürich).?1886. *Cyathophyllum ceratites* Frech (non Goldfuss), e.p.; F. Frech, *Die Cyathophylliden...*, Pl. 5, fig. 4.1896. *Ceratophyllum typus* Gürich; G. Gürich, *Das Palaeozoicum...*, p. 163.non 1954. *Ceratophyllum typus* Gürich; M. Rózkowska, *Badania wstępne...*, pp. 223—225, Figs. 14-17.non 1962. *Ceratophyllum typus* Gürich; E. Soshkina, *Gubki, Archeocyaty...*, Pl. 6, Fig. 2 a-b.*Diagnosis*. — Solitary corals, up to 22 mm in diameter; septa 36×2 in number, with not numerous, tubercular carinae; tabulae flat or concave, septal fossula at cardinal septum sometimes present.*Material*. — Solitary corals 27 in number, including 5 specimens from Gürich's original collection (locality unknown, probably Szydłówek), 22 specimens from Skały. The specimens mostly well preserved; numerous with calyces, several with proximal ends.*Description*. — Corallites trochoid, strongly bent, and widened at calyx (Pl. I, Figs. 1 b, 2), or slender and nearly conical (Pl. I, Fig. 3). Calyx usually shallow, with flat, outspread margin and gently oblique walls (Pl. I, Fig. 1 a). Epitheca with numerous, distinct growth wrinklins and weakly marked longitudinal grooves, reaches the outspread, calycal margin.

Cross-section (Pl. II, Figs. 1, 2 a-b, 4). Major septa long, reaching nearly axis of corallite, thickened in peripheral and on boundary with tabularium, ornamented by not numerous, tubercular carinae. Minor septa, reaching 1/3 of length of major septa, slightly thickened, somewhat outstanding beyond the dissepimentarium. Cardinal septum of various length, but not longer than adjacent major septa, which may form a septal fossula. Widened bases of septa penetrate thin epitheca.

Dissepimentarium composed of 2-4 circles of dissepiments, the peripheral broad, remaining ones small. Walls of innermost ring, often strongly thickened.

Longitudinal section (Pl. II, Fig. 3). Dissepiments convex, arranged in horizontal or semicircular rows. Peripheral rows always leaned on one side against epitheca, horizontal. Tabularium occupying up to 2/3 of corallite diameter. Tabulae incomplete, horizontally arranged or concave, with flat tabellae. Deposit of stereoplasma present in places.

Ontogenic development (Pl. II, Fig. 5 a-f). — It was not possible to trace the beginning of the appearance of septa. The youngest recognizable

section represents already the neanic stage. It is 1.8 mm in diameter, and displays 12 bilaterally arranged septa, with counter septum dominating, which prolongs beyond the corallite axis (Pl. II, Fig. 5 a-c). The cardinal septum is here longer than the adjacent metasepta, and it is joined with the counter septum.

The minor septa appear from the counter septum towards the cardinal one. At the same time, a dissepimentarium develops in the same direction (Pl. II, Fig. 5 d-f). The major septa, near the counter septum, prolonged beyond the axis of a corallite are arranged parallelly to this septum. Next, separation of cardinal and counter septum takes place (Pl. II, Fig. 5 f). In this stage of development, the bilateral symmetry is most distinctly pronounced. In the ephelic stage, it is often replaced by pseudo-radial symmetry.

Individual variability:

Cat. No. Z. Pal. P. Tc	Diameter (in mm)	Number of septa	Remarks
2/368	15.5 × 16.5	30 × 2	In calyx
2/368	7.2 × 8.0	27 × 2	Under calyx
2/373	10.2 × 11.2	32 × 2	Under calyx
2/377	6.8 × 7.8	23 × 2	Under calyx
2/381	3.8 × 4.6	22	Late neanic stage with incomplete number of minor septa
2/399	12.5 × 12.5	29 × 2	Under calyx
1/ 2	17.3 × 17.3	30 × 2	Specimen from Gürich's collection, under calyx
1/ 1	19.0 × 24.0	36 × 2	In calyx

The species shows a significant variability. The great differences are displayed in the length and arrangement of the major septa, from bilateral with distinctly delimited, shortened cardinal septum (Pl. II, Fig. 1) to pseudoradial. The carination of septa occurs with different distinction. As is shown in the table above, the number of septa, and especially the diameters of calyces, vary in large limits. As the result of heterochronic development, the morphology of corallites with the same numerical data can be different.

Remarks. — Gürich's specimens at the present author disposal differ from those, which Gürich described himself only in the larger diameters of the calyces. Thus, the original description was based probably on other specimen, which is lost.

It seems, however, that taking into account the broad limits of the individual variability (which is especially true for the diameters of corallites), the specimens described above can be considered as typical for the genus and subspecies *Ceratophyllum typus typus* Gürich, 1896.

Ceratophyllum typus skalense Gürich, 1896

(Pl. I, Figs. 4-6; Pl. II, Figs. 6-7)

1896. *Ceratophyllum typus* var. *skalensis* Gürich; G. Gürich, Das Palaeozoicum..., pp. 163, 164.

Diagnosis. — *Ceratophyllum* with deep calyx, 8—18 mm in diameter; septa short, 22×2 to 28×2 in number, provided with prominent carinae; tabulae convex.

Material. — Fifteen solitary corals from brachiopod shales of Skały, in that number one with well-preserved calyx and several with proximal ends.

Cross-section (Pl. II, Fig. 6). Septa with prominent, tubercular carinae, penetrating thin epitheca. Major septa short, on boundary with tabularium strongly thickened. Minor septa reaching only inner wall, which is formed by contacting septa and a deposit of stereoplasma on walls of inner ring of dissepiments.

Dimensions of specimens:

Cat. No. Z. Pz1. P. Tc	Diameter (in mm)	Number of septa
2/369	11.2×11.6	21×2
2/369	5.5× 5.5	16×2
2/398	8.0× 8.0	21×2
2/407	9.5× 9.5	20×2
2/-09	12.9×13.0	28×2

Longitudinal section (Pl. II, Fig. 7). Dissepimentarium narrow; dissepiments small, convex, arranged in 2-3 rows, horizontally at margin, form characteristic, outspread margin of calyx. Tabularium wide, occupying about 2/3 of corallite diameter. Tabulae convex, rarely flat, incomplete, with tabellae. Trabecular half-fans present.

Remarks. — The specimens described above are assigned to *Ceratophyllum typus skalense* Gürich, in spite of their smaller diameters and smaller number of septa, because their morphology corresponds to Gürich's description, they come from the same beds, and especially because they show the prominent carinae on the septa. The specimen Tc 2/409 (Pl. II, fig. 6) has, moreover, the same number of septa as that mentioned by Gürich.

With corresponding diameters, *C. typus skalense* differs from the nominal subspecies in the shape of its calyx (Pl. I, Fig. 4), which is deep, the stronger carinae on septa, the convex tabulae, and the smaller number of septa.

Occurrence. — Known only from Lower Givetian of Skały.

Ceratophyllum eifeliensis n.sp.

(Pl. I, Fig. 7 a-b; Pl. III)

1954. *Ceratophyllum typus* Gürich; M. Rózkowska, *Badania wstępne...*, pp. 223—226, Figs. 14—17.

Holotype: Specimen Tc. 2/456; Pl. I, Fig. 7 a-b.

Type horizon: Eifelian, mudstones (complex III, according to Pajchlowa, 1957).

Type locality: Grzegorzowice, Holy Cross Mountains.

Derivation of the name: *eifeliensis* — occurring in Eifelian.

Diagnosis (according to Rózkowska, 1954, p. 223). — “Corals in the shape of a bent corn, or somewhat elongate, conical, with not numerous offsets increasing on the margin of a deep calyx; epitheca thin, through which the interseptal ridges are visible. Some distance from the external pseudotheca (epitheca) the internal pseudotheca occurs. Septa — two lengths, number 38×2 , when diameter is 25 mm. Tabulae incomplete. Dissepiments globular. In youth bilateral symmetry prominent. Microstructure of septa trabecular. Arrangement of trabeculae fan-shaped”.

Material. — The specimens described by Rózkowska in 1954.

Blastogeny (Pl. III). Not numerous, small buds are formed at the margin of calyx, on the boundary between the tabularium and dissepimentarium. Budding begins with secretion of a massive clot of stereoplasma on the axial ends of several septa. This clot forms a kind of basal plate for the young individual (Fig. B₂). In this stereoplasma, 6-8 thick septa develop early. They are partly a continuation of the axial ends of the septa of the parent corallite, in the bud (Fig. B₃). Simultaneously, a part of epitheca is formed, separating the budding sector from the interior of the calyx of the parent corallite (Figs. A₁₋₅, B₃₋₇).

During further development, major septa are added successively and the free axial field is enlarged. Next, minor septa are formed (simultaneously) at the inner side of the parental calyx (Figs. A₅, B₇). The final part of the above considered hystero-nepionic stage is the closing of the epitheca of the young individual, which successively cuts off, so far connected, the marginal septa of a bud, from those of the parent corallite (Fig. B_{6,7}). In the offset A, this part is damaged and infilled with a deposit.

During the hystero-neanic stage (Fig. A₆₋₈), the young individual displays already all the characters of an adult one. During the successive development, dissepimentarium widens, the number of septa and the diameter increase.

Remarks. — The specimens mentioned, assigned by the present writer to *Ceratophyllum eifeliensis* n.sp., were regarded by Rózkowska (1954) on the basis of Gürich's description as *C. typus* Gürich. The originals of Gürich had not been identified at that time. The present author, while investigating the corals from the Lower Givetian of Skały (*C. typus typus*

and *C. typus skalense*) stated that the specimens in question, coming from the Eifelian of Grzegorzowice, should be assigned to a new species.

As there was no need for the redescription and illustration of the species mentioned, the present writer has only completed the investigations by reporting its blastogeny.

C. eifeliensis n.sp. differs from *C. typus typus* Gürich in having much larger dimensions, more numerous septa, wider dissepimentarium and short major septa, wedge-shaped in tabularium. The latter character makes this species close to *C. typus skalense*, from which it differs by its much weaker carinae on the septa and by its dimensions. Besides, it is the only budding species in the material here investigated.

*Palaeozoological Laboratory
of the Polish Academy of Sciences
Poznań, Świerczewskiego 19
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JERZY FEDOROWSKI

REWIZJA RODZAJU CERATOPHYLLUM GÜRICH, 1896 (TETRACORALLA)

Streszczenie

Przeprowadzono rewizję rodzaju *Ceratophyllum* Gürich, 1896, na podstawie 5 ocalałych po wojnie okazów G. Güricha, uzupełnionych materiałami, zebranymi przez autora z dolnego żywetu Skał. Ustalono neotyp (okaz No. Tc 1/1) oraz gatunek typowy — *Ceratophyllum typus* Gürich. Przedyskutowano przynależność opisanych dotychczas gatunków tego rodzaju i ustalono jego diagnozę.

Diagnoza. — Korale osobnicze lub słabo pączkujące, o septach I i II rzędu, przeważnie zaopatrzonych w kariny; dissepimentarium złożone z wypukłych dissepimentów, ułożonych w przekroju podłużnym półkuliście; epiteka dochodzi do wyniętego brzegu kielicha; asymetryczne wachlarze lub półwachlarze trabekul; w ontogenezie bardzo wyraźna symetria biletarna, z dominującym septum przeciwnym, zanikająca w stadium efebicznym.

Ponadto opracowano ponownie podgatunki *C. typus typus* Gürich i *C. typus skalense* Gürich i wprowadzono nowy gatunek *C. eifeliensis* n.sp., opisany uprzednio przez Rózkowską (1954) jako *C. typus* Gürich. Opracowano ontogenezę u *C. typus typus* Gürich, charakterystyczną dla rodzaju, oraz blastogenezę u *C. eifeliensis* n.sp.

РЕВИЗИЯ РОДА *CERATOPHYLLUM* GÜRICH, 1896 (TETRACORALLA)

Резюме

Проведено ревизию рода *Ceratophyllum* Gürich, 1896 на основании уцелевших после войны 5 образцов Гюриха, дополненных материалами, которые автор собрал в нижеживетском ярусе в местности Скалы (Свентокржиские Горы). Автор установил неотип (образец № Tc 1.1) и типичный вид *Ceratophyllum typus* Gürich. Обсуждено принадлежность до сих пор описанных видов этого рода и установлено его диагноз.

Диагноз. — Кораллы одиночные или слабо почкующие с септами I и II ряда, по большей части снабженными каринами; диссепиментариум сложено с выпуклых диссепиментов, расположенных в продольном разрезе в виде полукруга; эпитека доходит к вывернутому краю чашечки; асимметрические вееры или же полувееры трабекул; в онтогенезе очень четкая билатеральная симметрия, с доминирующей противоположной септой; асимметрия эта исчезает в эфебической стадии.

Кроме этого, изучено вновь подвиды *C. typus typus* Gürich и *C. typus skalense* Gürich и установлено новый вид *C. eifeliensis* n. sp., описанный раньше Ружковской (Itózkowska, 1954) как *C. typus* Gürich. Изучено онтогенез у *C. typus typus* Gürich свойственный для рода, а также бластогенез у *C. eifeliensis* n. sp.

PLATES

Plate I

Ceratophyllum typus typus Gürich

Fig. 1. Specimen Tc 1/1, neotype; *a* top view of calyx, *b* side view.

Fig. 2. Specimen Tc 1/4; side view.

Fig. 3. Specimen Tc 2/379, Skały, brachiopod shales; side view.

Ceratophyllum typus skalense Gürich

Fig. 4. Specimen Tc 2/369, Skały, brachiopod shales; calyx.

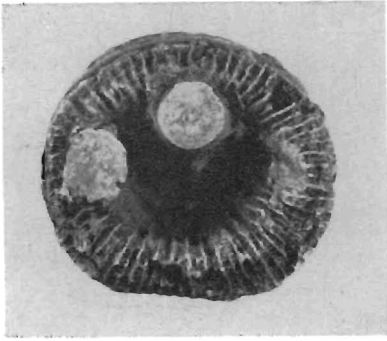
Fig. 5. Specimen Tc 2/447, Skały, *Microcyclus* shales; side view.

Fig. 6. Specimen Tc 2/446, Skały, *Microcyclus* shales; side view.

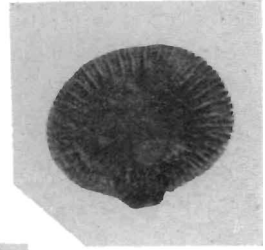
Ceratophyllum eifeliensis n.sp.

Fig. 7. Specimen Tc 2/456, holotype, Grzegorzowice, mudstones, Eifelian; *a* calyx with buds, *b* side view.

All figures in natural size



7a



1a



1b



7b



3



2



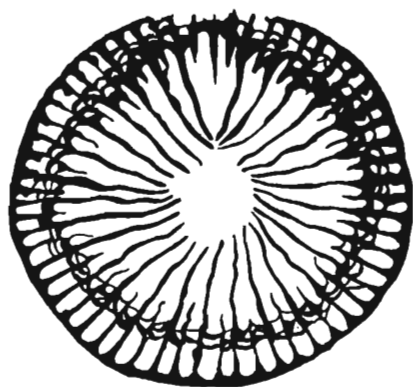
4



5



6



1



6



f



2b



7



e



2a



d



c



b



a



3



4

1.0

1.2

0.3

0.3

0.2

5

Plate II

Ceratophyllum typus typus Gürich

Fig. 1. Specimen Tc 1/2; cross-section.

Fig. 2. Specimen Tc 1/5; cross-section of early ephebic and ephebic stage.

Fig. 3. Specimen Tc 1/3, longitudinal section.

Fig. 4. Specimen Tc 2/399, Skały, brachiopod shales; cross-section.

Fig. 5. Specimen Tc 2/392, Skały, brachiopod shales; cross-section of successive development degrees of neanic stage.

Ceratophyllum typus skalense Gürich

Fig. 6. Specimen Tc 2/409, Skały, brachiopod shales; cross-section.

Fig. 7. Specimen Tc 2/378, Skały, brachiopod shales; longitudinal section.

Figs. 1—3 from Gürich's original collection

All figures $\times 3$

Plate III

Ceratophyllum eifeliensis n.sp.

Figs. 1—8. Budding observed on buds *A* and *B*.

Bud *A*, Figs. 1—5 — hystero-nepionic stage,

Figs. 6—8 — hystero-neanic stage.

Bud *B*, Figs. 2—8 — hystero-nepionic stage.

All figures $\times 3$

