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MONOCERATINA ROTH (OSTRACODA) FROM THE UPPER
CRETACEOUS AND LOWER PALEOCENE OF NORTH
AND CENTRAL POLAND

Abstract. — 17 species of the ostracod genus *Monoceratina* Roth (including 9 new species and 1 new subspecies) are described. The new subfamily Monoceratininae, placed tentatively in the family Bythocytheridae, is erected, and taxonomic features of the genus *Monoceratina* are discussed. The variability, ontogenetic development and the geographical distribution of the described species are studied.

INTRODUCTION

The Upper Cretaceous and Lower Paleocene ostracods from Poland have not been investigated so far. In 1961, the present author started studies on the ostracods of this age from north and central Poland. In the material studied *Monoceratina* Roth is represented by 17 species in a very good state of preservation. As an elaboration of the whole ostracod material from the named formations will take some time, the writer decided to publish separately her observations on *Monoceratina*.

The samples investigated were from the following localities: the boring at Pamiętowo in Pomerania (Upper Cretaceous and Lower Paleocene), the boring at Sochaczew near Warszawa (Upper Cretaceous and Lower Paleocene), the outcrops of the Upper Cretaceous at Mielnik on the river Bug, the outcrops of the Upper Cretaceous in Bochothnica, Kazimierz and Nasiłów on the Vistula. The representatives of *Monoceratina* were found in all the mentioned localities, except Sochaczew.

The samples from Pamiętowo and Sochaczew belong to the Geological Institute and were placed at the disposal of the present writer by the courtesy of Prof. W. Pożaryski. The samples from Mielnik were received from Mrs E. Bieda (Geological Institute). Those from Bochothnica, Kazimierz and Nasiłów were obtained from Prof. K. Pożaryska and Prof. W. Pożaryski. By the courtesy of Prof. K. Pożaryska the author received

also the comparative samples from Rügen, Holland and North America. Dr J. Małecki has provided the writer with the comparative samples of the Upper Cretaceous marls from Miały near Grodno (Belorussian SSR). All the mentioned samples were already macerated.

The investigations have been carried out at the Palaeozoological Institute of the Polish Academy of Sciences under the supervision of Prof. K. Pożaryska who has always been willing to show her assistance and kindly placed her library at the writer's disposal. Prof. R. Kozłowski discussed some problems with the writer and proffered useful criticism. Prof. Z. Kielan-Jaworowska read the manuscript of the present paper and offered valuable assistance. The discussions with Dr F. Adamczak have been of great value for the writer's investigations. Many thanks are also due to Dr I. G. Sohn from U.S. Geological Survey for some data on *Mono-ceratina*, to Prof. P. C. Sylvester-Bradley from the University of Leicester and to Dr J. P. Harding from British Museum for help in getting comparative material of Recent *Bythocythere* from British Museum (Natural History) of London. The photographs have been taken by Miss L. Łuszczewska, the drawings — by Mrs K. Budzyńska. To all these persons and institutions the writer wishes to express her sincere thanks and gratitude.

The material described is housed in the Palaeozoological Institute of the Polish Academy of Sciences, under the catalogue number (O.I/1-211).

MATERIAL AND THE CHARACTERISTICS OF LOCALITIES

The facial development of the Upper Cretaceous and Lower Paleocene beds in north and central Poland is different in various localities.

List of the localities and their age

Borings	Age	Number of samples
Pamiętowo	Lower Maastrichtian — Danian — Paleocene	16
Sochaczew	” ” ” ”	22
Outcrops		
Mielnik	Upper Campanian — Lower Maastrichtian	8
Kazimierz	Upper Maastrichtian	2
Bochoznica	Upper Maastrichtian — Danian — Paleocene	16
Nasiłów	” ” ” ”	2

Boring at Pamiętowo near Chojnice in Pomerania

The foraminifers from this boring have been described by Brotzen and Pożaryska (1961). The authors state that this boring represents Maastrichtian beds, developed as limestones, and Danian and Paleocene beds, developed as argillaceous marls, passing into detritic limestones with cherts.

Boring at Sochaczew near Warszawa

The stratigraphy and lithology of this boring is to be elaborated by K. Pożaryska. According to her opinion (personal communication), the boring consists of the Maastrichtian developed as calcareous-siliceous beds, passing into the argillaceous limestones of the Danian and Paleocene age.

Outcrop at Mielnik on the river Bug

The stratigraphy of the section in the quarry near Góra Zamkowa was recognized by Bieda (1958) on the foraminifers, and by Pożaryski (1960) on the macrofauna. The outcropping beds include the Upper Campanian and the Lower Maastrichtian in the chalk facies.

Outcrops in Kazimierz, Bochońnica and Nasiłów on the Vistula

The stratigraphy and lithology of these outcrops was elaborated by Pożaryska (1952). In all these localities the Upper Maastrichtian beds are

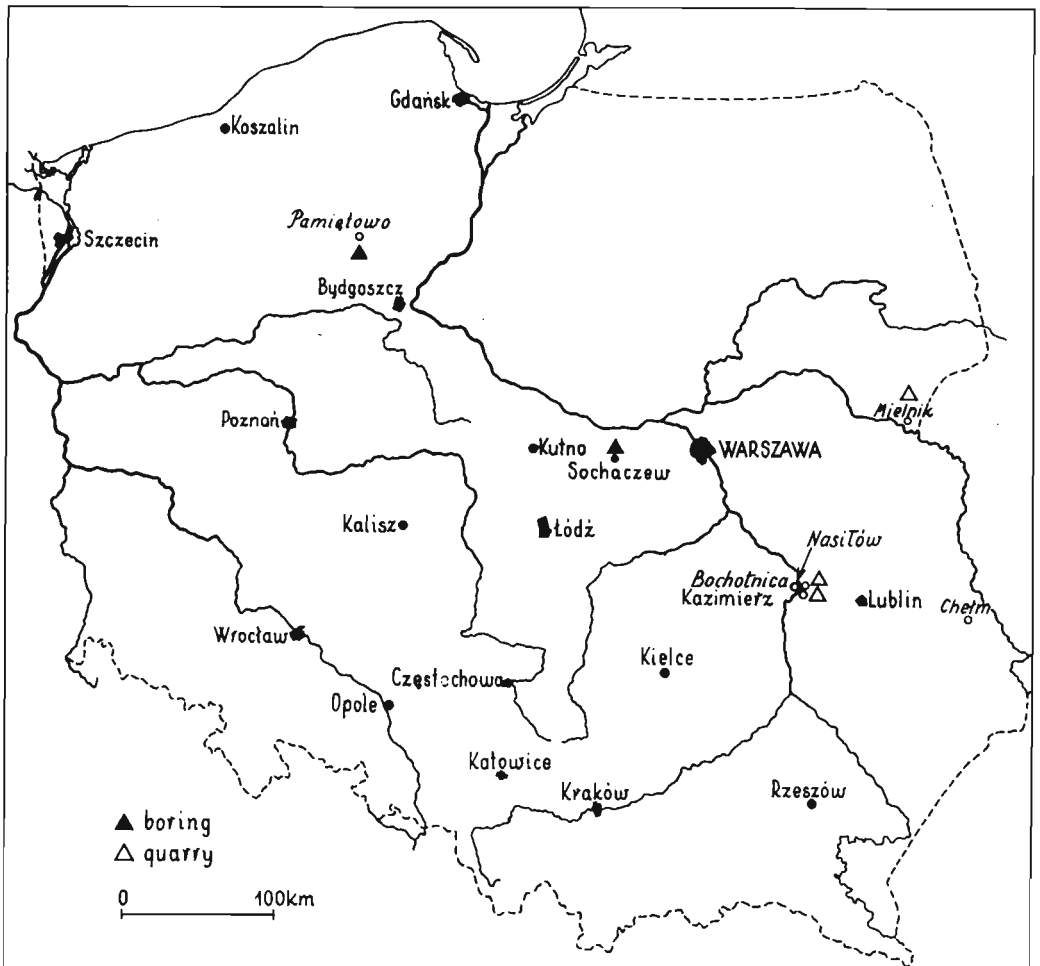


Fig. 1. — Distribution of borings and quarries

developed as a calcareous "opoka" with intercalations of marls. In Bocho-
tnica, Danian and Paleocene beds rest on the Maastrichtian. They are de-
veloped as the "gaize" with calcareous intercalations, forming the series
of the so-called "siwak".

The samples from all the mentioned localities, containing rich ostracod
fauna, have been carefully examined to collect a satisfactory number
of ostracods. The representatives of *Monoceratina* were found only in the
calcareous or marly beds. *Monoceratina* are especially numerous in chalk
facies of Mielnik and in the marly intercalations in opoka at Kazimierz
and Bochothnica. At Sochaczew and in the upper part of the Paleocene at
Pamiętowo, where the argillaceous-calcareous facies prevail, and in the
siwak of Bochothnica, the representatives of *Monoceratina* have not been
found, though other ostracod genera are fairly common there.

From all the mentioned localities, more than 500 specimens belonging
to 17 species of *Monoceratina* were found. They are mostly well preserved,
though usually very fragile and easily damaged.

TERMINOLOGY

The terminology of the different morphological elements of valve here
used has been taken from Kesling (1951), Sylvester-Bradley (1956), Howe
& Laurencich (1958), Morkhoven (1962) and others.

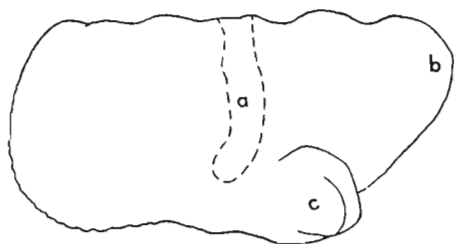


Fig. 2. — *Monoceratina tuberosa* n.sp.,
left valve, outside view (only the main
morphological elements) a sulcus, b caudal
process, c lateral prolongation

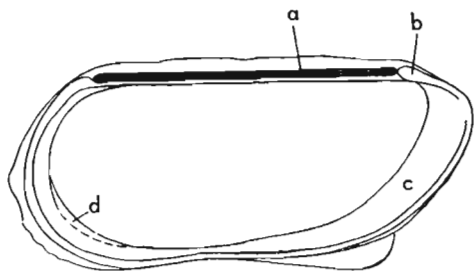


Fig. 3. — *Monoceratina tuberosa* n.sp.,
right valve, inside view; a hinge groove,
b terminal projection, c duplicature, d vestibule

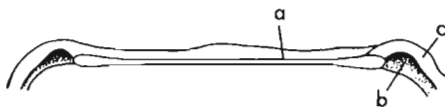


Fig. 4. — *Monoceratina tuberosa* n.sp., hinge margin of left valve; a bar, b terminal
socket, c hinge ear

MONOCERATINA IN THE UPPER CRETACEOUS AND
LOWER PALEOCENE OF POLAND
(Table 1)

The representatives of *Monoceratina* from the Upper Cretaceous and Lower Paleocene of Poland, described in the present paper, are derived from five localities (Table 1). A comparison of the assemblages of the representatives of *Monoceratina* in different samples shows that there are two main assemblages, connected with different facies.

The first assemblage is characteristic of the chalk facies as well as the marl intercalations in the opoka. It has been found in the Upper Campanian and Lower Maastrichtian beds of Mielnik, and in the Upper Maastrichtian of Bochoznica, Kazimierz and Nasiłów. It includes the following species: *Monoceratina pedata* (Marsson, 1880), *M. longispina* (Bosquet, 1854), *M. laeviooides laeviooides* Bonnema, 1941, *M. montuosa* (Jones, 1875), *M. umbonata* (Williamson, 1848), *M. staringi* Bonnema, 1941, *M. mielnicensis* n.sp., *M. bugensis* n. sp., *M. compacta* n. sp. and *M. polonica* n. sp.

Table 1
Distribution of *Monoceratina* species in the Upper Cretaceous
and Lower Paleocene of Poland

Species	Campanian	Lower Maastrichtian	Upper Maastrichtian	Lower Paleocene
<i>Monoceratina strangulata</i> (Bosquet, 1854)	—	—	—	+
<i>M. mielnicensis</i> n.sp.	—	+	+	—
<i>M. bugensis</i> n.sp.	—	+	+	—
<i>M. pedata</i> (Marsson, 1880)	—	+	—	—
<i>M. staringi</i> Bonnema, 1941	—	+	—	—
<i>M. longispina</i> (Bosquet, 1854)	—	+	—	—
<i>M. acanthoptera</i> (Marsson, 1880)	—	+	—	—
<i>M. laeviooides similis</i> n.subsp.	—	+	—	—
<i>M. flata</i> n.sp.	—	+	—	—
<i>M. crassa</i> n.sp.	—	+	—	—
<i>M. brevispina</i> n.sp.	—	+	—	—
<i>M. compacta</i> n.sp.	—	+	—	—
<i>M. tuberosa</i> n.sp.	—	+	—	—
<i>M. polonica</i> n.sp.	—	+	—	—
<i>M. howensis</i> n.sp.	+	+	—	—
<i>M. umbonata</i> (Williamson, 1848)	+	+	—	—
<i>M. montuosa</i> (Jones, 1875)	+	+	—	—
<i>M. laeviooides laeviooides</i> Bonnema, 1941	+	—	—	—

+ absent
— present,

This assemblage is accompanied by the representatives of the following genera: *Cytherella* Jones, 1848; *Bairdia* McCoy, 1844; *Cythereis* Jones, 1850, and others.

The second assemblage is characteristic of the limestone facies of the Lower Maastrichtian of Pamiętowo and is represented by the following species: *Monoceratina acanthoptera* (Marsson, 1880), *M. strangulata* (Bosquet, 1854) found in the Lower Paleocene only, *M. pedata* (Marsson, 1880) represented by a single specimen, *M. umbonata* (Williamson, 1848) represented by a single specimen, *M. bugensis* n.sp. represented by a single specimen, *M. flata* n.sp., *M. brevispina* n.sp., *M. tuberosa* n.sp. and *M. crassa* n.sp.

This assemblage is accompanied by the representatives of the genera: *Loxoconcha* G. O. Sars, 1866; *Hemicythere* G. O. Sars, 1925; *Eucythere* Brady, 1866; *Clithrocyteridea* Stephenson, 1936, and others. It appears that the new species of *Monoceratina*, found in Pamiętowo, are characteristic of the limestone facies occurring there. Almost all the Cretaceous species of *Monoceratina* described earlier were found in the chalk or marly facies.

MONOCERATINA IN THE UPPER CRETACEOUS OF EUROPE

(Table 2)

About 50 species of *Monoceratina* have been hitherto described from the Upper Cretaceous of Europe. Out of these, 8 have been found by the present writer in the Upper Cretaceous of Poland. In the comparative samples from the Upper Cretaceous of Rügen, studied by the present writer, in addition to 4 species of *Monoceratina* cited by Marsson (1880), as belonging to *Cythere*, two more species, viz. *M. montuosa* (Jones, 1875) and *M. mielnicensis* n. sp. have been found.

In the samples from the locality of Miały¹ (Belorussian SSR), studied for comparison, of the Campanian age, three species of *Monoceratina* have been found: *M. stiringi* Bonnema, 1941, *M. umbonata* (Williamson, 1848) and *M. montuosa* (Jones, 1875). The geographical distribution of the representatives of *Monoceratina*, described in the present paper, is given on Table 2. Poland, Rügen, Holland, Great Britain and Belorussian SSR belong in the Cretaceous times to one sedimentary basin (cf. Gignoux, 1956). In all these countries similar sediments, mainly chalk and marls, were accumulated, yielding numerous species of *Monoceratina*.

The representatives of *Monoceratina*, described in the present paper,

¹ The age of the beds from Miały has been recognized by the present author on the base of the following foraminifers, characteristic of the Campanian of central Poland (vide Pożaryska, 1954, and Pożaryski & Witwicka, 1956): *Globotruncana marginata* (Reuss), *G. fornicata* Plummer, *Neoflabellina rugosa* (d'Orbigny), *Stensioeiina pommerana* Brotzen, *S. annae* Pożaryska and *Globorotalia micheliniana* (d'Orbigny).

form an assemblage characteristic of the Upper Cretaceous of west and central Europe only. Some species of *Monoceratina* here described, e.g. *M. acanthoptera* (Marsson), *M. pedata* (Marsson) and *M. umbonata* (Williamson), were cited from the Cretaceous beds of Texas by Alexander (1934), but the American specimens are, in the opinion of the present writer, not conspecific with European forms. Similarly *M. acanthoptera* (Marsson) and *M. montuosa* (Jones), recorded by Šarapova (1937) from the south of Asiatic part of U.S.S.R. do not seem to be conspecific with central European forms.

Table 2

Distribution of *Monoceratina* in the Upper Cretaceous of Europe *

Species	Poland	Rügen	Holland	Great Britain	Belorussian SSR
<i>Monoceratina strangulata</i> (Bosquet, 1854)	+	—	+	—	—
<i>M. mielnicensis</i> n.sp.	+	—	—	—	—
<i>M. bugensis</i> n.sp.	+	—	?	—	—
<i>M. pedata</i> (Marsson, 1880)	+	+	+	+	—
<i>M. staringi</i> Bonnema, 1941	+	—	+	—	+
<i>M. longispina</i> (Bosquet, 1854)	+	+	+	—	—
<i>M. acanthoptera</i> (Marsson, 1880)	+	+	+	—	—
<i>M. laeviooides laeviooides</i> Bonnema, 1941	+	—	+	—	—
<i>M. laeviooides similis</i> n. subsp.	+	—	—	—	—
<i>M. flata</i> n.sp.	+	—	—	—	—
<i>M. crassa</i> n.sp.	+	—	—	—	—
<i>M. brevispina</i> n.sp.	+	—	—	—	—
<i>M. compacta</i> n.sp.	+	—	—	—	—
<i>M. tuberosa</i> n.sp.	+	—	—	—	—
<i>M. polonica</i> n.sp.	+	—	—	—	—
<i>M. howensis</i> n.sp.	+	—	—	—	—
<i>M. umbonata</i> (Williamson, 1848)	+	+	+	+	+
<i>M. montuosa</i> (Jones, 1875)	+	+	+	+	+

* *M. strangulata* occurs in Poland only in the Lower Paleocene.

+ present,

— absent.

HISTORY OF INVESTIGATIONS ON MONOCERATINA

The genus *Monoceratina* has been erected by Roth (1928) to include *Monoceratina ventrale* Roth (recte *M. ventralis ventralis*) and *Monoceratina ventrale magnum* Roth (recte *M. ventralis magnum*), both from the Pennsylvanian of Oklahoma. Roth based his description of *M. ventralis*

on a few, small, more or less deformed specimens, characterized by elongated, inflated shells with a straight dorsal margin, rounded anterior margin, truncated postero-ventral edge, and a straight ventral margin, subparallel to the upper outline of the carapace. The most characteristic features of *M. ventralis* are: a small furrow, called sulcus, perpendicular to the dorsal margin, and the presence of a sharply pointed, alar process in the postero-ventral part of the valve.

Roth assigned *Monoceratina* to the family Primitiidae (in Beyrichiacea), probably due to the presence of the sulcus. This opinion was shared by Bassler and Kellet (1934). Harlton (1933) studying the Pennsylvanian microfauna of Oklahoma, found two species of *Monoceratina*: *M. ventralis* Roth and *M. ardmorensis* Harlton. This latter species is characterized by an alate inflation above the ventral margin of the valve, in contrast to the lateral prolongation with a corn-like process in *M. ventralis*. Harlton assigned *Monoceratina* to the Beyrichiidae, without discussing this question.

The entirely new characteristics of *Monoceratina* has been given by Alexander (1933, 1934a, 1934b) who described several species of this genus from the Cretaceous and Midway formation of Texas. Some of the species, assigned by him to *Monoceratina*, have been — according to him — described earlier from the Cretaceous of Europe under different generic names. He stated that the Pennsylvanian representatives of *Monoceratina* from Oklahoma are no doubt congeneric with the Cretaceous species described by him. He assigned *Monoceratina* to the family Cytheridae in Podocopa, because of the presence of the caudal process as well as the occurrence in some species of marginal thickening along the anterior margin, unknown in the Primitiidae. According to Alexander, the hinge in *Monoceratina* is straight, adont, and a line of concrescence coincides with the line of the internal margin. The most characteristic feature of *Monoceratina* is, in his opinion, the corn-like process in the postero-ventral part of the valve.

Swartz (1936) is of the opinion that the most characteristic features of *Monoceratina* are: the presence of sulcus in the first place, and the lack (at least in the type species) of the caudal process and the straight hinge margin. On the base of these features Swartz assigned *Monoceratina* to the new family Acronotellidae in Beyrichiacea.

Polenova (1952) places the new species *Monoceratina similis* Polenova from the Givetian of the Russian Platform in the Acronotellidae. The valves of this species, figured by her, show a considerable variation in the development of the lower part of the carapace: in some of them a rounded ridge is present, passing into the process in the postero-ventral part of the valve, in others the lower part of the valve is smooth.

Henningsmoen (1953) is of the opinion that *Monoceratina* is not related to *Acronotella*, as suggested by Swartz. According to him, the pre-

sence of the caudal process in the representatives of *Monoceratina* allows one to assign this genus to the Podocopa, though the hinge in some species of *Monoceratina* reminds one of the hinge in the Ropolonellinae.

Sylvester-Bradley (1956) regards with some reservations *Monoceratina* as the oldest representative of Cytheracea — as had been suggested by Alexander — calling attention to the fact that *Monoceratina* differs from the remaining representatives of Cytheracea in the shape of the carapace, in muscle scars and in the obscure structure of the hinge.

Numerous species of *Monoceratina* were described by van Veen (1936, 1938) and Bonnema (1940, 1941) from the Cretaceous of Holland. These authors accept the definition of this genus given by Alexander, however the species described by them were more differentiated in the outline of the carapace and shell morphology than those described by Alexander. *M. tricuspadata* (Jones & Hinde), cited by both authors, has three fairly long spines, arranged close to each other above and along the ventral margin.

Triebel and Bartenstein (1938) described 11 species of *Monoceratina* from the Liassic and Dogger of Germany. The definition of *Monoceratina* given by them agrees in general with that of Alexander, though in some species from the Jurassic of Germany the characteristic process in the postero-ventral part of the valve is lacking. In *M. scrobiculata* Triebel & Bartenstein from the Liassic of south Germany, Fischer (1962) stated the presence of a crenulated, adont hinge and three muscle scars forming the main group, in front of which two additional scars are placed. All these authors assigned *Monoceratina* to the Cytheridae.

Van den Bold (1946) described some species of *Monoceratina* from the Cretaceous and Tertiary beds of the Caribbean region. According to him, *Monoceratina* is closely related to *Bythocythere* G. O. Sars, 1866, the only difference concerns the presence of the sulcus in *Monoceratina* which is lacking in *Bythocythere*. Van den Bold assigned both, *Bythocythere* and *Monoceratina*, to the subfamily Bythocytherinae G. O. Sars, 1927, in the Cytheridae. Stephenson (1946) described five new species of *Monoceratina* from the Eocene of Texas. In some species assigned by him to *Monoceratina* the sulcus and the spine-like process in the posterior part of the valve are lacking. Neither is the hinge margin in all the species straight. On the structure of *M. laevis* Stephenson, Stephenson stated that the muscle scar in *Monoceratina* consists of five scars, four of which are arranged close to each other in a vertical row, and one situated above the main group. The hinge is adont. Stephenson attributed *Monoceratina* to the Cytheridae. Referring to the so far undescribed species from Mexico Bay, he states that *Monoceratina* occurs also in Recent seas, the vertical range of this genus being thus very long.

Schmidt (1948) found new species of *Monoceratina* in the Cretaceous of Virginia. They are characterized by a straight dorsal margin, sulcus

and the presence of a spine, as well as the caudal process in the posterior part of the valve. This author assigned *Monoceratina* to the Cytheridae.

Swain and Peterson (1951) described a new species *Monoceratina sundancensis* from the Upper Jurassic of Dakota. It is characterized by: a straight hinge with obscure, weak notches at both ends of the hinge in each valve, more or less distinct sulcus and four muscle scars arranged vertically. Swain and Peterson also assigned *Monoceratina* to the Cytheridae.

Swain (1953) described a new species of *Monoceratina*: *M. cooperi* from the Devonian of Tennessee, assigned to an uncertain family. The valve in *M. cooperi* is elliptical, with adont hinge and a circular muscle scar. Swain, analysing the Paleozoic and post-Paleozoic representatives of *Monoceratina*, states that they differ in the shape of muscle scars and in the hinge structure. The Mesozoic and Cenozoic representatives of *Monoceratina* are characterized by a simple hinge, lack of the curvature in the midportion of the ventral margin, and muscle scars consisting of one, main group, without accessory scars in front of it. According to Swain (1953), *Monoceratina* cannot be attributed to the Cytheridae.

Puri (1954) described the new species *M. bifurcata* from the Miocene of Florida. According to the drawings of some specimens of this species, given by him, *M. bifurcata* shows variation in the dorsal margin which may be straight or have a slightly convex outline. The valve is elongated posteriorly, with a sulcus and alate process.

Lubimova (1955) includes numerous Mesozoic and Tertiary species of *Monoceratina* into synonymy of *Bythocythere*, and assigned them to family Paradoxostomidae Fischer, 1855. According to Lubimova, Palaeozoic species of *Monoceratina* are related to *Bythocythere*, but their shape, ornamentation and unknown type of hinge do not allow one to include them to *Bythocythere*. This author assigns to *Bythocythere* the following characteristic features: sulcus, lateral prolongation and tripartite hinge.

Keij (1957) recorded the occurrence of two *Monoceratina* species in the Oligocene of Belgium, assigning *Monoceratina* to the Bythocytherinae in the Cytheridae. Pokorny (1954) assigned *Monoceratina* to the subfamily Bythocytherinae in the Cytheridae and has been followed in this respect by Grekoff (1953). More recently however Pokorny (1958) has altered his opinion concerning the systematic position of *Monoceratina*, believing that the Jurassic and younger representatives of this genus do not correspond to the *Monoceratina* (sensu Roth), whereas the Palaeozoic representatives of this genus have much in common with Kloedenellidae.

Howe and Laurencich (1958) include *Monoceratina* to the Bythocytherinae (in the Cytheridae), regarding *Monoceratina* Roth and *Monoceratina* Alexander as congeneric. The only difference between *Monoceratina* and *Bythocythere* is, according to these authors, the presence of a pointed spine in *Monoceratina* which is lacking in *Bythocythere*. In the diag-

nosis of *Monoceratina*, they underline the adont hinge, the possibility of the occurrence of vestibule in the anterior part of the valve and call attention to the unknown type of the muscle scar. They assigned to this genus numerous species from the European and American Cretaceous, suggesting however that they may represent more than one genus.

In most recent systematics of Ostracoda there is also no agreement as to the systematic position of *Monoceratina*. Mandelstam (1959) includes Mesozoic species of *Monoceratina* and Recent species of *Bythocythere*. — to Bythocytherinae in Paradocostomatidae Brady & Norman, 1889, mainly on the base of five similar muscle scars. This author is in agreement with Lubimova's description of *Bythocythere*. In 1960, Kashevarova, Mandelstam and Schneider (*in Orlov*) include *Monoceratina* Roth to the group of uncertain systematic position, while *Monoceratina* Alexander is regarded by them as synonym of *Bythocytheromorpha* Mandelstam, 1958, and is assigned to Bythocytherinae, Paradoxostomidae Schweyer, 1940. In the diagnosis of *Monoceratina* these authors underline that in this genus the process in the postero-ventral part of valve is corn-like or tubercular, and never is produced into a spine, the hinge is adont, and on the anterior part of the valve a small deepening is present.

Sylvester-Bradley and Kesling (*in Moore*, 1961) assigned *Monoceratina* to the Bythocytheridae in Cytheracea, Podocopina. They regarded the Palaeozoic and Mesozoic representatives of *Monoceratina* as congeneric, taking into account the similar type of muscle scars (five scars), and the presence of the duplicature in both groups. They characterize *Monoceratina* as having an elongated valve, straight dorsal margin, caudal process, sulcus and modified lophodont hinge.

Plumhoff (1962) includes *Monoceratina* to Bythocytherinae, Cytheridae, and suggests that Palaeozoic and post-Palaeozoic species of *Monoceratina* are congeneric, and are related to *Bythocythere*. In his opinion, *Bythocythere* does not bear either sulcus or lateral prolongation. Plumhoff states that the hinge is not of great significance for a taxonomy of ostracods, for it is very similar in many genera, in contrast with muscle scars which are characteristic features of a family. In this author's opinion, muscle scars in *Monoceratina* are not uniformly regarded by most of the workers in this field.

Summing up the opinions of the above discussed authors — without giving a full account of the publications on *Monoceratina* — one can state that students of Palaeozoic ostracods assigned *Monoceratina* to the families: Primitiidae, Beyrichiidae or Acronotellidae, whereas the students of Mesozoic and Cenozoic ostracods assigned this genus to the Cytheridae, Bythocytheridae or Paradoxostomidae. Some investigators cannot define the systematic position of *Monoceratina*. Various authors regard not the same taxonomic features as the most important in the diagnosis

of this genus and state the large variability of morphological characters within this genus.

The present paper is an attempt to define the taxonomic characters of *Monoceratina* from the Cretaceous of Poland and the range of variability within this genus. On the new material from Poland the new subfamily Monoceratinae is erected, to include *Monoceratina* and other genera, and this subfamily is placed tentatively in the family Bythocytheridae Sylvester-Bradley & Kesling, 1961. The conclusions of the present author, concerning the systematic position of the new subfamily, are only tentative, as the knowledge of the Palaeozoic and early Mesozoic representatives of *Monoceratina* is still limited, and similarly not much is known as to the structure of the genera which may be related to *Monoceratina*, such as e.g. *Bythocythere*, *Triceratina* or *Neomonoceratina*. In the case of *Bythocythere*, there is no uniform opinion as to the morphological features of the carapace. The present author has at her disposal comparative material of Recent *Bythocythere*, i.e. *B. constricta* G. O. Sars, *B. dromedarius* G. O. Sars, *B. simplex* Norman and *B. bicristata* Brady & Norman. They differ very much in the shape of valve. Except for *B. bicristata*, none of the above mentioned species have a straight hinge margin, no lateral prolongation, and only in *B. constricta* is there a very weak sulcus. The hinge, seen only in *B. constricta*, is a simple, adont. Muscle scars and other internal features not visible.

VARIABILITY IN MONOCERATINA

Shape of valve

The representatives of *Monoceratina* from the Upper Cretaceous of Poland vary greatly in the shape of the valve. The outline of the carapace ranges from subtriangular, as in *M. mielnicensis* n.sp., through ovate, e.g. *M. crassa* n.sp., to subrectangular — in *M. acanthoptera* (Marsson). All the here described species have a straight dorsal margin, elongate valves, median sulcus and more or less distinct caudal process.

Relief and ornamentation

The species here described differ greatly from one another in the relief of the valves and in ornamentation. The valves are usually more or less inflated, but may be almost smooth (e.g. in *M. longispina* (Bosquet)), or ornamented. The ornamentation may be developed as spines — as in *M. umbonata* (Williamson), as a reticulation — as in *M. pedata* (Marsson) or as pits — as in *M. mielnicensis* n.sp. The process in the postero-ventral part of the valve occurs in the majority of species (the only exception being *M. crassa* n.sp.), and it may be developed as a spine or as an alar process. In *M. umbonata* (Williamson) it is developed as a long, pointed spine (comp. Pl. X, fig. 12), in *M. brevispina* (Pl. XI, fig. 9) — as a tuberc-

le. The spine may be situated in the postero-ventral part of the valve, or (e.g. in *M. tuberosa* n.sp.) at the base of the alar process. In *M. flata* n.sp. (comp. Pl.XI, fig. 5) an alar inflation occurs along the ventral margin of the valve, corresponding probably to the lateral process occurring in other species.

Muscle scars

The muscle scars in all the here described species consist of 5 scars, arranged in arcuate row. In some specimens only 4 scars are visible. Additional scars in front of the main group have never been observed. The present writer is of the opinion that both the sulcus in which the muscle scars are arranged, and the type of the muscle scars — are important taxonomic characters at the generic level.

Hinge

In all the described species the hinge is lophodont or modified adont (cf. Sylvester-Bradley, 1956). In the majority of species, e.g. in *M. mielnicensis* n.sp., *M. pedata* (Marsson) and *M. polonica* n.sp. the hinge in the left valve consists of a bar and terminal sockets, forming, as a rule distinct hinge ears, and in the right valve of a furrow and usually weakly developed terminal teeth. This type of hinge is often modified, e.g. in *M. umbonata* (Williamson) and *M. bugensis* n.sp. the terminal elements of hinge are indistinct; the middle element of hinge passes gradually into the contact element of the free margin, which may be seen especially in the posterior part of the hinge. In some species e.g. in *M. longispina* (Bosquet) the hinge is very indistinct.

Free margin

The development of the free margin, especially the zone of fusion, is different in the various species here described. The line of concrescence is as a rule parallel to the outer margin. The width of the duplicature is different in various species and within one species it may be more or less satisfactorily preserved. In almost all species the specimens have been found in which the vestibule was preserved.

Marginal and normal pore canals

The marginal and normal pore canals are usually poorly preserved. The presence of marginal canals has been stated in *M. pedata* (Marsson), where there are 9 straight canals occurring in the postero-ventral part of the valve in this species. The normal pore canals are usually badly preserved. In *M. flata* n.sp. the present author stated their presence; they are irregularly, rather scarcely arranged.

Size of valve

The smallest specimen representing mature individual has been found in *M. tuberosa* n.sp., measuring 0.55 mm in length, the largest in *M. pedata* (Marsson) being 1.0 mm in length.

In the samples from the Upper Cretaceous of Poland the valves within one species vary in dimensions, depending on the facies. E.g. the valves of *M. mielnicensis* n.sp. and *M. bugensis* n.sp. are larger in chalk facies, than in the calcareous opoka or in marls.

ONTOGENETIC DEVELOPMENT AND DIMORPHISM
IN SOME REPRESENTATIVES OF *MONOCERATINA*

The ontogenetic development in *Monoceratina* has not so far been described. In the present paper the presumably nearly complete ontogenetic developments of two species are described: *M. laevioides similis* n.subsp. (Pl. IX, fig. 9-13) and *M. umbonata* (Williamson) (Pl. X, fig. 9-13). Moreover, some ontogenetic stages of *M. laevioides laevioides* Bonnema, *M. montuosa* (Jones) and *M. bugensis* n.sp. have been found. Within the ontogenetic series of *M. laevioides laevioides* and *M. umbonata* five ontogenetic stages have been recognized, according to Przibram-Brooks law (Kesling, 1953). The same number of ontogenetic stages has been obtained on the graph illustrating length/height ratio in *M. umbonata*, based on the measurements of hundred specimens (Fig. 5). If based on Keslings' diagram later used by Błaszyk (1959) then they represent the last five instars out of a possible seven in a complete ontogenetic development.

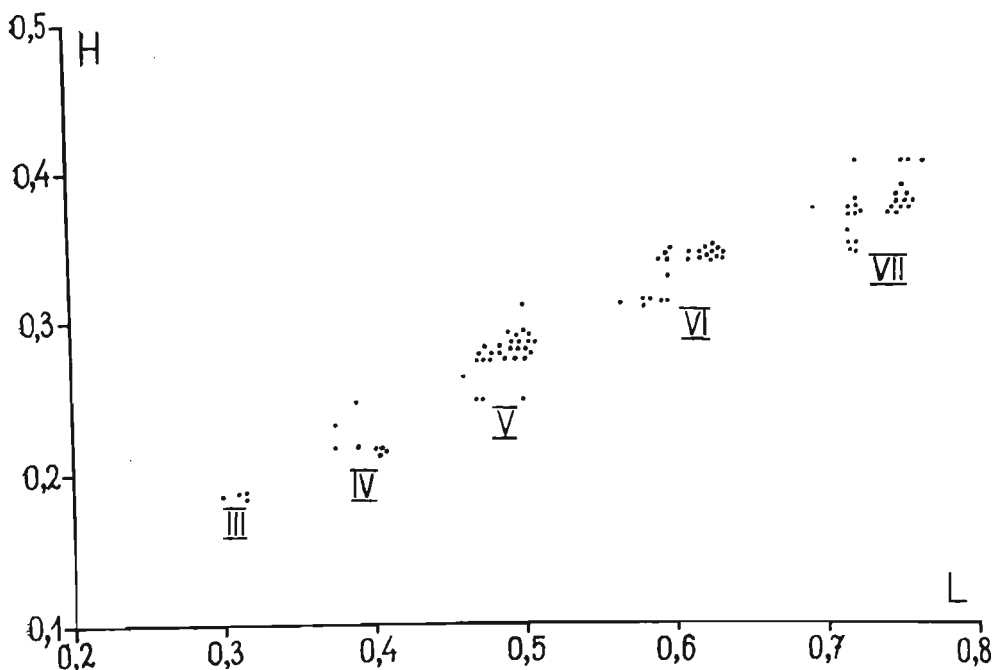


Fig. 5. — Scattergram of length/height ratio in *Monoceratina umbonata* (Williamson, 1848), in mm.: III—VII instars.

The young specimens in *Monoceratina* are similar to the adult forms, however the valves of adult specimens are longer with regard to height. Ornamentation and differentiation of the valve surface increase with growth. The duplicature of young specimens is very narrow or indistinct. The hinge is definitely developed in the last ontogenetic stage, in the younger stages being very indistinct.

In the majority of the here described species, one (adult) ontogenetic stage has only been found.

The preservation of young ontogenetic stages of particular species is connected with the facies. E.g. the young ontogenetic stages of *M. bugensis* n.sp. have been found in chalk facies only, whereas the adult representatives of this species occur also in opoka. On the other hand, in opoka facies, ontogenetic series of various species, belonging to other ostracod genera, have been found. Within the species described, the sexual dimorphism has been stated tentatively only in *M. crassa* n.sp. and *M. brevispina* n. sp. Unfortunately, the lack of the young stages of the above cited species does not permit one to deal with this problem in detail.

The dimorphism in the representatives of *Monoceratina* has been so far stated in a few species only, or has been stated tentatively (e.g. Bonnema, 1941; Plumhoff, 1963). It concerns the shape of the valves which in female specimens are shorter and higher with regard to the length and height of the male specimens.

Similar differences have been stated by the present writer in *M. crassa* n.sp. and *M. umbonata* (Williamson). *M. umbonata* is represented in the author's collection by adult as well as young specimens. However, the differences in the shape of the valves concern both adult and young forms. For this reason, they cannot be regarded as a result of sexual dimorphism.

DESCRIPTIONS

Suborder **Podocopa** Sars, 1866

Superfamily **Cytheracea** (Baird, 1850)

Family **Bythocytheridae** Sars, 1926, emend. Sylvester-Bradley, 1961

Subfamily **Monoceratininae** nov. subfam.

Diagnosis. — Valve elongated, with straight dorsal margin, a more prominent or less prominent caudal process and median sulcus. Adductor muscle scars arranged in an arcuate group of five scars within the sulcus. Hinge modified adont, lophodont or ?amphidont.

Stratigraphic range. — Devonian - Recent.

Geographical distribution. — North America, Europe, Asia, New Zealand.

Discussion. — The new subfamily is erected to include the following genera: *Monoceratina* Roth, 1928, ?*Triceratina* Upson, 1933, ?*Neomonoceratina* Kingma, 1948, *Bythoceratina* Hornibrook, 1953, and *Miracythere* Hornibrook, 1953.

The genus *Monoceratina*, erected by Roth (1928), was assigned by this author to the family Primitiidae Ulrich & Bassler, 1923. Later *Monoceratina* was attributed to different families by various authors (p. 367), while at the same time the definition of the genus changed. The present author's observations on the structure of the representatives of *Monoceratina* from the Upper Cretaceous of Poland, and a comparison of these forms with the descriptions and illustrations of Palaeozoic species — led to the conclusion that the Palaeozoic and Mesozoic forms are congeneric, as had already been suggested by Alexander (1933), Sylvester-Bradley and Kesling (1961), and Plumhoff (1963). The common features of the Palaeozoic and Mesozoic representatives of *Monoceratina* are: the similar shape of the valve, lophodont hinge, five adductor muscle scars and presence of the duplicature. The noticeable differences lie in the fact that in the Cretaceous forms from Poland there are no additional muscle scars in front of the adductor muscle scars, which have been mentioned in the Palaeozoic species.

The exact systematic position of *Monoceratina* is a difficult question. The presence of duplicature, lack of a distinct dimorphism, the type of the muscle scars and structure of the hinge — show that *Monoceratina* should be assigned to the superfamily Cytheracea within the Podocopa. Assignment to the lower taxonomic units, such as the family and subfamily, is however more difficult.

What characters of the ostracod valve should be regarded as a good taxonomic feature on the level of families and subfamilies, is still in question. Many ostracod students regard the type of muscle scars as the best taxonomic feature at family level, and details of their patterns — at subfamily level. The present author follows in general this approach, believing however that it would be more reasonable to take into account not one, but numerous characters, such as the hinge, the shape of the valve and the structure of the marginal area.

In *Monoceratina* there are five (sometimes only four are visible) central muscle scars arranged in a characteristic pattern. The muscle scars in *Monoceratina* have hitherto been studied only in a few species, the present author's observations on the species from the Upper Cretaceous of Poland, as well as those of Swain (1953) on the Mesozoic and Cenozoic forms show that in *Monoceratina* the additional muscle scars are lacking. In contrast to this, in the majority of genera, assigned to various families within the Cytheracea, four central muscle scars and two or three additional scars occur. In some genera, e.g. *Sclerochilus* G. O. Sars, 1868, *Miracythere* Hornibrook, 1953, and *Bythocytherina* Hornibrook, 1953, the

central muscle scars are of a similar pattern to those in *Monoceratina* — although in these genera additional muscle scars are present — and they are assigned by different authors to the same family as *Monoceratina*. *Miracythere*, *Bythocytherina* and *Monoceratina* were placed in the same subfamily Bythocytherinae (Mertens, 1958; Kashevarova, Mandelstam & Schneider, in Orlov, 1960).

Out of the above mentioned genera, only *Bythocytherina* and *Miracythere* seem to have much in common with *Monoceratina* and it seems justified to assign them to the same subfamily as *Monoceratina*.

Monoceratina and the four related genera, cited on p. 372, differ from other representatives of Cytheracea in the pattern of the muscle scars, hinge structure and shape of the valve, *Neomonoceratina*, however, differs with certainty only in shape of the valve. These genera have often been placed in the Bythocytherinae, but they differ in numerous features from *Bythocythere*, the typical genus of this subfamily.

The subfamily Bythocytherinae (equivalent of the family Bythocytheridae in the classification of Sylvester-Bradley and Kesling, 1961) has been erected by G. O. Sars in 1926, to include the following Recent genera: *Bythocythere* G. O. Sars, 1866, *Pseudocythere* G. O. Sars, 1866, and *Macrocythere* G. O. Sars, 1926. In the present writer's opinion, none of the above cited genera should be assigned to the same subfamily as *Monoceratina*. *Pseudocythere* and *Macrocythere* differ from *Monoceratina* in having quite different external characters, a different pattern of muscle scars and a different hinge structure.

The type species of *Bythocythere* is *B. turgida* G. O. Sars. The muscle scars of *B. turgida* (Sylvester-Bradley, 1947, p. 720, fig. 2) and *Bythocythere* sp. (Morkhoven, 1962, p. 58, fig. 50b) differ greatly from those in *Monoceratina*. There are six central muscle scars, whereas five in *Monoceratina*, moreover the muscle scars are differently arranged and shaped. If based on illustration of *B. turgida* given by Sylvester-Bradley (1947), it appears that this species is quite different in outline from *Monoceratina*, having a differently shaped marginal area of the free margin of valve, different hinge and lastly the sulcus, so characteristic of *Monoceratina*, is lacking in *B. turgida*.

Because of these differences the present writer considered it impossible to assign *Monoceratina* and *Bythocythere* to the same subfamily. The new subfamily Monoceratininae is thus erected here to include *Monoceratina* and four related genera. This new subfamily is tentatively placed in the Bythocytheridae, on the base of the similarities in the external morphology of the representatives of Monoceratininae and Bythocytherinae.

The Palaeozoic genus *Triceratina* Upson, 1933, has been assigned by Upson to the Primitiidae. Cooper (1941) and Mertens (1958) placed it in Acronotellidae. Bassler and Kellet (1934) regarded *Triceratina* as a syn-

onym of *Monoceratina*. Sylvester-Bradley and Kesling (1961) included *Triceratina* together with *Monoceratina* to the Bythocytheridae in Cytheracea. *Triceratina* is not a well known genus, but in the shape of the valve it strongly reminds one of *Monoceratina*. As the muscle scars and hinge in *Triceratina* are unknown — it is placed in the new subfamily only tentatively.

The genus *Neomonoceratina* Kingma, known from the Miocene and recently occurring in the Malayan region, has been assigned by Kingma (1948), Grekoff (1956) and Mertens (1958) to the subfamily Bythocytherinae in the Cytheridae. Later it has been placed by various authors in different subfamilies within the Cytheridae (by Pokorný (1958) and Morkhoven (1962) — in the Cytherurinae, by Oertli (1958) — in the Cytherinae), and lastly by Howe (1961, in Moore) — in the Schizocytheridae. *Neomonoceratina* is similar to *Monoceratina* in the shape of the valve and in the presence of median sulcus. In Kingma's opinion there are only four muscle scars arranged vertically within the sulcus. The genera in question differ in the structure of the hinge which is amphidont in *Neomonoceratina*, whereas lophodont or modified adont in *Monoceratina*. In spite of the differences in the hinge structure, the similarities of these genera were pointed out by some authors (Kingma, 1948, and Grekoff, 1956). In the opinion of present writer, *Neomonoceratina* is probably an offspring of *Monoceratina* with modified hinge. *Neomonoceratina* is also placed tentatively in the new subfamily.

The genera *Bythoceratina* Hornibrook and *Miracythere* Hornibrook have been placed by Hornibrook (1953) in the Bythocytherinae within the Cytheridae, and by Sylvester-Bradley and Kesling (1961) in the Bythocytheridae in Cytheracea. Both genera, in particular *Bythoceratina*, are similar to *Monoceratina* in the shape of valve, in the arrangement of the central muscle scars within the sulcus and in the hinge structure. In *Bythoceratina* and *Miracythere*, in addition to the central muscle scars, additional muscle scars as a rule are present. In *Bythoceratina* a small supplementary muscle scar occurs usually above the main group of scars. The lophodont hinge in *Bythoceratina* is more specialized than in *Monoceratina*, as the median bar in the left valve is here crenulated. In *Miracythere* the hinge is modified in comparison with *Bythoceratina* and *Monoceratina*. In the right valve, in posterior part of the hinge, there is a terminal simple socket with a tooth above, matched to the opposite elements in the left valve, but this may be regarded as a feature characteristic of the genus.

Various authors, in discussing the relations of *Monoceratina* to different genera, cited — in addition to the here assigned genera — *Loxiconcha* Sars, 1866, *Ortonotacythere* Israelsky, 1929, and others.

The morphological characters of these genera, such as the shape of the valves, hinge structure and muscle scars, differ however so much

from those in *Monoceratina* that, in the present writer's opinion, there is no base for assigning them to the same subfamily or even family as *Monoceratina*.

Genus *Monoceratina* Roth, 1928 (= *Bythocytheromorpha* Mandelstam, 1958)

Type species: Monoceratina ventralis ventralis Roth, 1928

Diagnosis. — Valve elongated, ovate, subtriangular or subrectangular, with more prominent or less prominent caudal process. The dorsal margin straight, ventral margin parallel to the dorsal or tapering, especially in the posterior part, in the middle part slightly concave. Medial sulcus present with 5 muscle scars within the sulcus. In the postero-ventral part of the valve a spine or the alar process along the ventral margin is present. The relief and ornamentation of the valve may vary from smooth to complicated. Duplicature in Mesozoic species distinct, generally wide. Marginal canals straight, not numerous. Normal canals irregularly, scarcely arranged. Hinge in Mesozoic species modified adont or lophodont.

Stratigraphic range. — Devonian - Recent.

Geographical distribution. — North America, Europe, Asia.

Discussion. — Numerous Palaeozoic, Mesozoic and Cenozoic species from all over the world have been assigned to *Monoceratina*. Owing to the great number of species, often inadequately described, and illustrated, the present writer is unable to revise all of them critically. In only a few species of *Monoceratina* were the hinge and muscle scars properly described. If based on the shape of the valve — it appears that the assignment of the majority of species, especially Mesozoic ones, to *Monoceratina* — is justified.

Monoceratina pedata (Marsson, 1880)

(Pl. I, fig. 2 a-b, 3; VIII, fig. 1, 2)

1880. *Cythere pedata* Marsson; T. Marsson, *Die Cirripedien und Ostracoden...*, p. 46, Pl. 3, fig. 16a.
1890. *Cytheropteron pedatum* (Marsson); T. R. Jones & G. J. Hinde, *A supplementary monograph...*, p. 38, Pl. 4, fig. 33-35.
- ?1933. *Monoceratina pedata* (Marsson); C. I. Alexander, *Shell structure...*, p. 203, Pl. 27, fig. 15 a-b.
- ?1934. *Monoceratina pedata* (Marsson); C. I. Alexander, *Ostracoda...*, p. 60.
- non 1941. *Monoceratina pedata* Marsson; J. H. Bonnema, *Ostracoden aus der Kreide...*, p. 29, Pl. 6, fig. 37-39.
1941. *Monoceratina pedatoides* Bonnema; J. H. Bonnema, *Ibid.*, p. 29, Pl. 6, fig. 40-46.
- ?1946. *Monoceratina pedata* (Marsson); W. A. van den Bold, *Contribution...*, p. 116, Pl. 14, fig. 8.
- ?1948. *Monoceratina pedata* (Marsson); R. A. Schmidt, *Ostracoda from the Upper Cretaceous...*, p. 411, Pl. 61, fig. 10.

non 1958. *Monoceratina pedata* (Marsson); H. V. Howe & Laurencich, Introduction to the study..., p. 415

Material. — 16 left and 12 right valves, in many cases damaged, almost equal in size, from Lower Maastrichtian of Mielnik, and 1 right valve from Lower Maastrichtian of Pamiętowo.

Dimensions (in mm.):

	(O.I/1) Right valve	(O.I/2) Left valve
Length	1.00	0.97
Height	0.50	0.50

Description. — A solid, elongate, subovate carapace, length to height ratio as 2:1. Both valves of carapace very similar in size, shape and ornamentation. Dorsal margin straight, ventral margin obliquely truncated, somewhat concave in middle. Anterior end broadly rounded, posterior narrowly rounded, elongate. Carapace, except for peripheral parts of valve, evenly inflated, divided by median sulcus. Lower part of sulcus the deepest, surrounded posteriorly by a rounded thickening. A sharp, long spine extends laterally below and behind sulcus. Margins of valve rimmed and finely spiny. Dorsal margin bears two almost parallel rims, exterior one dividing posteriorly for a short distance to rejoin again. Surface covered by numerous fine spines, arranged concentrically at ventral margin. Valves may be also distinctly pitted or reticulated.

Muscle scars (Pl. I, fig. 3) consist of five scars, arranged in somewhat arcuate row in sulcus region, which appears to be typical for this genus. Normal pore canals not visible. Marginal canals (cf. Pl. I, fig. 2a) straight, not numerous, visible only in posterior part of ventral margin. Duplication wide, with large vestibule in antero-ventral and postero-ventral part of valve.

Hinge of right valve consists in a straight, narrow furrow, terminated by a weakly developed dent. Posterior terminal element is elongate, flattened, while the anterior one is rather conically rounded. In left valve hinge consists of a projecting, fine bar terminated by sockets forming distinct hinge ears.

Variation concerns mainly the ornamentation of valve, which may be reticulated distinctly when the number of spines is small, or covered by well developed spines rendering the reticulation less clear. There are some forms with a transitional kind of ornamentation, which indicates that all here assigned specimens are conspecific.

Remarks. — Marsson (1880) described *Cythere pedata* (recte *Monoceratina pedata*) from Upper Cretaceous of Rügen. This species has been cited later by numerous authors from the Cretaceous of England, Upper Cretaceous of Holland, United States and Caribbean region. In the pre-

sent writer's opinion, the specimens described by Bonnema (1941) as *M. pedata* from Upper Cretaceous of Holland are not conspecific with *M. pedata* (Marsson) from Rügen, and belong to *M. mielnicensis* n.sp. described in the present paper. The specimen figured by Howe (1958) and assigned to *M. pedata* (p. 415), also shows some similarities with *M. mielnicensis*, differing however from the latter in having a spiny valve surface, which in *M. mielnicensis* is only pitted.

In the synonymy of *M. pedata*, on p. 375 of the present paper, four positions are given tentatively (Alexander, 1933, 1934; van den Bold, 1946, and Schmidt, 1948). The present author cannot venture an opinion as to whether the specimen figured by the authors in question are in fact conspecific with *M. pedata* (Marsson) or not, on account of the inaccuracy of their illustrations.

Judging from the figures of *M. pedatoides* Bonnema, given by Bonnema (1941, Pl. 6, fig. 40-46), the specimens figured by him are very similar to those of *M. pedata* from Poland and Rügen, and are considered here as conspecific. In the specimens of *M. pedata* from Poland the posterior end is distinctly rounded, in those from Rügen it may be similarly rounded as in Poland or pointed, whereas in the Upper Cretaceous of Holland — judging from the figures of *M. pedatoides* given by Bonnema — the valve is pointed posteriorly.

M. pedata is slightly similar to *M. mielnicensis*, especially in samples from Maastrichtian of Rügen, where ostracod valves are not well preserved. In samples from Lower Maastrichtian of Poland they are better preserved and the difference between *M. pedata* and *M. mielnicensis* (see p. 380) is more distinct.

Occurrence. — Maastrichtian of Rügen², Cretaceous of England, Upper Cretaceous of Holland. In Poland — Lower Maastrichtian of Mielnik and Pamiętowo

Monoceratina compacta n.sp.

(Pl. I, fig. 4, 5; VIII, fig. 3, 4)

Holotypus: Pl. VIII, fig. 3 (O.I/6).

Stratum typicum: Lower Maastrichtian.

Locus typicus: Mielnik, Poland.

Derivatio nominis: *compacta* — Lat. *compactus* = compact, named after the compact valve.

Diagnosis. — Carapace triangularly ovate, slightly swollen, with thickened rim along free margin, with long, sharp spine in the back, lower portion. Surface coarsely pitted.

Material. — 3 right and 4 left valves, usually damaged, similar in size, from Lower Maastrichtian of Mielnik.

² *M. pedata* was found in comparative material from Maastrichtian of Rügen.

Dimensions (in mm.):

	(O.I/6) Right valve	(O.I/7) Left valve
Length	0.94	0.94
Height	0.53	0.53

Description. — Carapace thick, massive, triangularly ovate, elongate, length to height ratio somewhat less than 2:1. Both valves of carapace similar in size, shape and ornamentation. Dorsal margin straight, ventral margin somewhat truncated, slightly concave in middle. Anterior end broadly rounded, posterior end more narrowly rounded. The valves slightly swollen in the centre, compressed at the borders, particularly at the ends, bearing median sulcus. Sulcus deepest in its lower part, where a distinct, arched furrow is visible. Behind sulcus, near ventral margin, there is a sharp, long spine and some short prickles arranged below sulcus in an arched row. Valves bordered by a thick rim, especially well developed along free margin. Rim minutely spiny dividing on dorsal side in two almost parallel rims. Surface coarsely pitted; pits arranged regularly, enlarging at the borders. At dorsal margin the pits merge forming distinct grooves.

Muscle scars (Pl. I, fig. 5) typical for genus. Normal and marginal pore canals obscured. Duplicature wide, forming large vestibule anteriorly and posteriorly. Hinge (Pl. I, fig. 4) like in *M. pedata*, but generally with strongly thickened anterior part of bar in right valve.

Remarks. — *Monoceratina compacta* is somewhat similar in shape and ornamentation to *M. mielnicensis* n.sp., but is larger, with less drawn out posterior end. The ventral margin of *M. compacta* is less truncated than in *M. mielnicensis*, having different ornamentation of the valve; pits in *M. compacta* merge at dorsal margin, while in *M. mielnicensis* they are always separated.

Occurrence. — Lower Maastrichtian of Mielnik, Poland.

Monoceratina mielnicensis n.sp.

(Pl. II, fig. 2-4; VIII, fig. 7-10; XI, fig. 4, 10)

1941. *Monoceratina pedata* Marsson; J. H. Bonnema, Ostracoden aus der Kreide..., p. 29, Pl. 6, fig. 37-39.

Holotypus: Pl. VIII, fig. 8 (O.I/12).

Stratum typicum: Lower Maastrichtian.

Locus typicus: Mielnik, Poland.

Derivatio nominis: *mielnicensis* — after the locality Mielnik.

Diagnosis. — Carapace subtriangular, slightly swollen, with long, sharp spine behind. Marginal rim thickened, on dorsal side divided in two. Surface pitted.

Material. — 32 right and 29 left valves from Upper Maastrichtian of

Bochotnica, Nasiłów and Kazimierz; 13 right and 9 left valves from Lower Maastrichtian of Mielnik. Valves somewhat different in size, in most cases damaged.

Dimensions (in mm.) of 10 specimens (5 right and 5 left valves):

from Mielnik			from Bochotnica		
	Right valve	Left valve		Right valve	Left valve
	(O.I/192-201)			(O.I/202-211)	
Length	1.00	0.94	Length	0.81	0.81
	0.94	0.91		0.78	0.78
	0.94	0.91		0.78	0.72
	0.94	0.91		0.81	0.81
	0.91	0.94		0.81	0.78
Height	0.44	0.47	Height	0.41	0.41
	0.41	0.47		0.37	0.37
	0.44	0.44		0.37	0.34
	0.44	0.44		0.41	0.37
	0.41	0.42		0.37	0.37

Description. — Carapace solid, subtriangular, elongate, length to height ratio more than 2 : 1. Both valves of the carapace very similar in size, shape and ornamentation. Dorsal margin straight, ventral margin oblique, slightly concave in middle. Anterior end rounded, posterior end pointed, forming a distinct caudal process. Valve slightly swollen, especially in antero-ventral part, divided by weakly marked median sulcus. Lower part of the sulcus deepest, forming a distinct, short furrow, surrounded ventrally by an arcuate row of short spines. Postero-ventral part of valve bears a long, sharp, corn-like spine. Marginal rim of valve raised, divided in two almost parallel parts along dorsal margin and generally with minute spines. Surface pitted. Pits arranged regularly, enlarging at borders.

Muscle scars (Pl. II, fig. 4) typical for genus. Normal and marginal pore canals indistinct. Duplicature wide, vestibule best developed anteriorly and posteriorly. Line of concrescence almost parallel to outer margin. Hinge (cf. Pl. II, fig. 2b) like in *M. pedata* (Marsson).

Variation concerns size of specimens and is probably connected with the facies from which they derive. Two distinct groups of specimens may be distinguished from their size:

1) specimens from chalk (Lower Maastrichtian) of Mielnik are 0.91—1.00 mm. in length, and 0.41—0.47 mm. in height;

2) specimens from a calcareous "opoka" with intercalations of marls (Upper Maastrichtian) of Kazimierz and Bochotnica are 0.72—0.81 mm. in length, and 0.34—0.41 mm. in height.

Remarks. — *Monoceratina mielnicensis* is slightly similar to *M. pedata* (Marsson, 1880), but it is more triangular in outline, with sharply pointed posterior end and pitted surface of valve, whereas *M. pedata* has distinctly rounded posterior end, and spiny or reticulated surface.

Occurrence. — Upper Cretaceous (Maastrichtian?) of Holland, Maastrichtian of Rügen³. In Poland — Lower Maastrichtian of Mielnik and Upper Maastrichtian of Bochoznica, Kazimierz and Nasiłów.

Monoceratina polonica n.sp.

(Pl. I, fig. 1 a-c; VIII, fig. 5, 6)

Holotypus: Pl. VIII, fig. 6 (O.I/5).

Stratum typicum: Lower Maastrichtian.

Locus typicus: Mielnik, Poland.

Derivatio nominis: *polonica* — described from Poland.

Diagnosis. — Carapace subtriangularly ovate, evenly swollen, with long, sharp spine in the back lower portion. Free margin rimmed forming thick, spiny rib more developed anteriorly, curving outwards. Surface reticulated, prickled.

Material. — 3 right and 2 left valves, similar in size, from Lower Maastrichtian of Mielnik.

Dimensions (in mm.):

	(O.I/4) Right valve	(O.I/5) Left valve
Length	0.97	0.97
Height	0.45	0.47

Description. — A solid carapace, subtriangularly ovate, elongate, length to height ratio almost as 2 : 1. Both valves very similar, nearly equal in size, shape and ornamentation. Dorsal margin straight, ventral margin subparallel, somewhat concave in middle, arcuately truncated posteriorly. Anterior end broadly rounded, posterior end sharply angulated above middle, elongate. Valve moderately, evenly swollen, divided by median sulcus. Lower part of sulcus the best pronounced, forming a distinct furrow. Below and behind sulcus is a long, sharp spine. Margins of valve are thickened. Dorsal side bears two closely lying, parallel ribs; exterior rib divides posteriorly for a short distance to rejoin again. Anterior margin bears also two ribs which are separated; exterior rib bends outwards, forming a deep furrow between anterior margin and frontal inflation of the valve. Surface reticulated and spiny. Pits of frontal part arranged in subvertical rows forming indistinct furrows, obscu-

³ *M. mielnicensis* n.sp. was found in comparative material from Lower Maastrichtian of Rügen (chalk), where it is similar in size to specimens from Mielnik.

red by fine spines directed backwards. Valve rims prickled; anterior rim covered by numerous spines, especially well developed.

Muscle scars typical for genus (Pl. I, fig. 1c). Normal and marginal pore canals obscured. Duplicature wide, forming large vestibule at ventral margin. Hinge (Pl. I, fig. 1a) like in *M. pedata*; there is a distinctly thickened posterior end of the bar in left valve.

Occurrence. — Lower Maastrichtian of Mielnik, Poland.

Monoceratina laevioides laevioides Bonnema, 1941

(Pl. IX, fig. 14-17)

1941. *Monoceratina laevioides* Bonnema; J. H. Bonnema, Ostracoden aus der Kreide..., p. 29, Pl. 6, fig. 47-53.
 1958. *Monoceratina laevioides* Bonnema; H. V. Howe & L. Laurencich, Introduction to the study..., p. 410.

Material. — 17 left and 9 right valves, of different size, from Campanian of Mielnik, out of which 11 valves are damaged.

Dimensions (in mm.):

	Right valve	Left valve
Length max.	0.69 (O.I/25)	0.69 (O.I/186)
Length min.	0.37 (O.I/22)	0.34 (O.I/185)
Height max.	0.34 (O.I/25)	0.44 (O.I/186)
Height min.	0.22 (O.I/22)	0.25 (O.I/185)

Description. — Carapace thin, delicate, subtriangular, elongate, length to height ratio in mature form as 2 : 1. Both valves of carapace about the same size, shape and ornamentation. Dorsal margin straight, ventral margin obliquely truncated, somewhat concave in middle. Anterior end rounded, posterior end sharply angulated, elongate. Carapace slightly, evenly swollen, especially in the middle near ventral margin, divided by median sulcus. Behind and below sulcus there is a long, pointed spine. Below sulcus appears arcuate row of short spines. Usually indistinct folds occur in front of the sulcus. Along and at anterior margin a very weak rib appears, generally spiny. Surface of valve finely ornamented. It bears short spines, especially well developed in frontal part and on anterior margin. On dorsal side spines form two parallel rows, exterior one divides posteriorly for a short distance to rejoin again.

Muscle scars indistinct. Normal and marginal pore canals not visible. Duplicature narrow, line of conrescence parallel to outer margin. Type of hinge like in *M. pedata*.

Variation concerns size, shape and ornamentation as a result of differentiation of the valve during ontogeny.

Ontogeny. — Four instars (probably III-VI) can be recognized between specimens assigned to *M. laevioides laevioides*. Taking under con-

sideration the size, shape and development of their hinge margin and comparing them with the same characters of *M. laevioides similis* n.subsp. which has five instars, it seems that they represent only young moult stages, without mature specimens.

Instar III — Dimensions (in mm.): length 0.37, height 0.22. Carapace subtriangular, ventral margin not concave in middle. Spine behind sulcus weakly developed. Ornamentation very weak. Duplicature and hinge indistinct.

Instar IV — Dimensions (in mm.): length 0.45, height 0.25. Carapace subtriangular, more elongate, ventral margin slightly concave in middle. Spine behind sulcus very short. Surface bears some small prickles at dorsal, ventral and anterior margin. Duplicature and hinge weakly developed, rather obscured.

Instar V — Dimensions (in mm.): length 0.56, height 0.28. Carapace similar in shape and ornamentation to older forms. Spine behind sulcus distinct. Duplicature narrow, hinge margin weakly differentiated.

Instar VI (premature instar) — Dimensions (in mm.): length 0.69, height 0.34. In comparison with younger stages, its characters are more developed (cf. description).

Remarks. — *Monoceratina laevioides laevioides* is somewhat similar to *Cythere pedata* var. *laevis*, recte *Monoceratina pedata laevis* (Marsson, 1880), but as stated by Bonnema (1941) *M. laevioides laevioides* is more delicate, with more distinct sulcus and without thickened margin of valve, characteristic for *M. pedata laevis*. *M. laevioides laevioides* is also similar to *M. laevioides similis* n.subsp. (see p. 384).

Occurrence. — Upper Cretaceous (Maastrichtian?) of Holland. In Poland — Campanian of Mielnik.

Monoceratina laevioides similis n.subsp.

(Pl. II, fig. 1; IX, fig. 9-13)

Holotypus: Pl. II, fig. 1; IX, fig. 13 (O.I/20).

Stratum typicum: Lower Maastrichtian.

Locus typicus: Mielnik, Poland.

Derivatio nominis: *similis* — Lat. *similis* = similar to *M. laevioides laevioides* Bonnema.

Diagnosis. — Carapace ovately triangular, evenly swollen, with long, pointed spine behind sulcus. Below sulcus row of short prickles arcuately arranged. Surface covered by not very numerous, irregularly arranged, short spines, especially well developed in frontal part and along dorsal margin.

Material. — 18 right and 20 left valves of different size, in most cases damaged, from Lower Maastrichtian of Mielnik.

Dimensions (in mm.):

	Right valve	Left valve
Length max.	0.84 (O.I/20)	0.83 (O.I/21)
Length min.	0.34 (O.I/16)	0.40 (O.I/183)
Height max.	0.47 (O.I/20)	0.47 (O.I/21)
Height min.	0.22 (O.I/16)	0.22 (O.I/183)

Description. — Carapace thin, ovately triangular, elongate, length to height ratio in mature forms somewhat less than 2 : 1. Both valves of carapace very similar in size, shape and ornamentation. Dorsal margin straight, ventral margin slightly convex, somewhat concave in the middle. Anterior margin broadly rounded, posterior margin narrowly rounded, almost angulated, elongate. Carapace evenly swollen, divided by faint median sulcus. Behind sulcus is a long, pointed corn-like spine. At the base of sulcus some short prickles in an arcuate row. Surface of valve covered by not numerous, irregularly arranged spines and prickles, especially well developed in front and on free margin. Anterior margin bears a double rib, covered by fairly short spines. On dorsal side, spines form two ribs; exterior rib divides posteriorly for a short distance to rejoin again.

Muscle scars indistinct. Normal and marginal pore canals obscured. Duplicature narrow. Line of concrescence parallel to outer margin. Hinge (Pl. II, fig. 1) like in *M. pedata*, but less distinct.

Variation concerns size, shape and ornamentation of valve as a result of presence of different instars (cf. ontogeny).

Ontogeny. — Five out of a possible seven instars can be recognized in the ontogenetic development of *M. laevioides similis*.

Instar III — Dimensions (in mm.): length 0.34, height 0.22. Carapace subtriangular, slightly elongate. Sulcus and spine behind sulcus weakly developed. Ornamentation almost lacking. Duplicature and hinge indistinct.

Instar IV — Dimensions (in mm.): length 0.41, height 0.25. Carapace subtriangular but more elongate, ventral margin somewhat concave. Sulcus and spine behind sulcus more pronounced. Ornamentation weak. Duplicature and hinge obscured, weakly differentiated.

Instar V — Dimensions (in mm.): length 0.53, height 0.32. Carapace ovately subtriangular, all characters more developed. Duplicature narrow, hinge margin rather weakly differentiated.

Instar VI — Dimensions (in mm.): length 0.62, height 0.34. Carapace very similar in shape and ornamentation to those of next instar. Hinge and duplicature also resemble next instar.

Instar VII (mature instar) — Dimensions (in mm.): length 0.84, height 0.47. In present writer's opinion, it represents mature form.

Comparing measurements of all instars of *M. laeviooides similis* n.subsp. it may be seen that during ontogenetical development, length to height ratio changes, valve being longer in older specimens. Shape of the valve also changes, being more ovate in older specimens.

Remarks. — *Monoceratina laeviooides similis* n.subsp. is similar to *M. laeviooides laeviooides* Bonnema, 1941, but is more swollen and more ovate, with rounded posterior end, bearing richer ornamentation.

Occurrence. — Lower Maastrichtian of Mielnik, Poland.

Monoceratina montuosa (Jones, 1875)

(Pl. III, fig. 2; VIII, fig. 11-14)

1875. *Cythere (Cythereis) montuosum* Jones; *vide* 1941, J. H. Bonnema, Ostracoden aus der Kreide..., p. 41.
 1890. *Cytheropteron cuspidatum* var. *montuosa* Jones & Hinde; T. R. Jones & G. J. Hinde, A supplementary monograph..., p. 38, Pl. 3, fig. 14-16.
 non 1934. *Monoceratina montuosa* (Jones); C. I. Alexander, *Monoceratina*..., p. 62, Pl. 8, fig. 5.
 1941. *Monoceratina montuosa* Jones; J. H. Bonnema, Ostracoden aus der Kreide..., p. 41, Pl. 7, fig. 1-9.
 non 1958. *Monoceratina montuosa* (Jones & Hinde); H. V. Howe & L. Laurencich, Introduction to the study..., p. 411.

Material. — 7 left and 9 right valves of different size from Campanian and Lower Maastrichtian of Mielnik. Valves in most cases damaged.

Dimensions of 3 right and 1 left valves (in mm.):

	Length	Height
Right valve	0.72	0.31 (O.I/35)
	0.62	0.25 (O.I/34)
	0.47	0.19 (O.I/33)
Left valve	0.60	0.25 (O.I/36)

Description. — Carapace thin, delicate, subtriangular, elongate, length to height ratio in mature form somewhat more than 2 : 1. Both valves of carapace rather similar in shape, size and ornamentation. Dorsal margin straight, ventral margin obliquely truncated, slightly concave in middle. Anterior end almost straight, rounded in the bottom. Posterior end pointed, elongate in a distinct caudal process. Valve divided by deep median sulcus, surrounded by considerable horseshoe-like inflation, more developed frontally. Lower part of inflation underlined by two nearly parallel, arcuate ribs. The higher one ends anteriorly in a small tubercle, posteriorly in a fairly short, sharp spine. Dorsal margin bears four prickled tubercles; first in antero-dorsal angle, second — before sulcus, third — behind sulcus, fourth corresponds with posterior, terminal element of the hinge; it lies in the middle between third tubercle and posterior end of the dorsal margin. Free margin rimmed, generally spiny. Anterior margin distinctly swollen, bearing in lower part some spines longer than

those on ventral margin, separated by deep concavity from frontal inflation.

Muscle scars indistinct. Marginal and normal pore canals not visible. Duplicature fairly wide, especially at antero-ventral margin, forming there rather large vestibule. Hinge type (Pl. III, fig. 2) like in *M. pedata*.

Ontogeny. — Three out of a possible seven instars can be recognized in the ontogenetic development of *M. montuosa*, in all probability the three last.

Instar V — Dimensions (in mm): length 0.47, height 0.19. Shape of valve like that in older specimens, but its relief less distinctly differentiated. Free margin unrimmed, not spiny. Duplicature and hinge margin indistinct.

Instar VI — Dimensions (in mm.): length 0.62, height 0.25. Ornamentation of valve well developed. Hinge and duplicature weakly formed.

Instar VII — Dimensions (in mm.): length 0.72, height 0.31. All characters better developed (cf. description).

Remarks. — Jones (1875) described *Cythere (Cythereis) montuosum* (recte *Monoceratina montuosa*) as nomen nudum. Later, in 1890, Jones and Hinde regarded *Cythere (Cythereis) montuosum* as a synonym *Cytheropteron cuspidatum* var. *montuosa*. The illustration of that species given by these authors is not clear, but permits one to state similarity with *M. montuosa* from Poland. *M. montuosa* described by Alexander (1934), from Upper Cretaceous of America and cited later by Howe (1958), differs from specimens from Poland having differently formed ventral and frontal part of valve. *M. montuosa*, described by Bonnema (1941) from Upper Cretaceous of Holland, is very similar to *M. montuosa* from Poland, although it is reticulated, while specimens from Poland are smooth.

Occurrence. — Upper Cretaceous of England or Ireland (type locality not designated), Holland and Miały⁴ (Belorussian SSR). In Poland — Campanian and Lower Maastrichtian of Mielnik.

Monoceratina howensis n. sp.

(Pl. III, fig. 3 a-b, 4; IX, fig. 1, 2, ?3)

Holotypus: Pl. III, fig. 3 a, b; IX, fig. 2 (O.I/29).

Stratum typicum: Lower Maastrichtian.

Locus typicus: Mielnik, Poland.

Derivatio nominis: *howensis* — named in honour of American palaeontologist Dr H. V. Howe.

Diagnosis. — Carapace subtriangular, swollen, with long, sharp spine in the back lower partion. Anterior marginal part of valve swollen, forming an antero-dorsal and antero-ventral rim, separated by a deep con-

⁴ Three smooth specimens were found in comparative material from Miały.

cavity from frontal inflation. Surface covered by numerous short spines, arranged in subconcentric rows on ventral side and at antero-ventral margin, and on dorsal side arranged in straight rows, parallel to dorsal margin. Anterior rims covered by somewhat longer spines.

Material. — 8 right and 3 left valves from Lower Maastrichtian and 2 right valves from Campanian of Mielnik, similar in size, in most cases damaged.

Dimensions (in mm.):

	(O.I/28) Right valve	(O.I/29) Left valve
Length	±0.62	0.69
Height	0.28	0.28

Description. — Carapace rather solid, subtriangular, elongate, length to height ratio more than 2 : 1. Both valves of carapace about equal in size, shape and ornamentation. Dorsal margin straight, ventral margin straight, nearly parallel, truncated posteriorly. Posterior end angulated, elongate in caudal process. Anterior end broadly rounded, almost straight. Frontal part of valve considerably swollen, more than back part which is compressed posteriorly. Median sulcus well developed. Behind and below sulcus a long, sharp, corn-like spine, directed backwards. The most peripheral, anterior part of valve inflated, forming two rims along anterior margin, separated by a deep concavity from frontal inflation of valve. Surface covered by numerous short spines, arranged subconcentrically on ventral side and at antero-ventral margin and on dorsal side arranged in straight rows parallel to dorsal margin. Spines on anterior rims somewhat longer than others. In the antero-dorsal region of valve coarse pits sometimes appear.

Muscle scars (Pl. III, fig. 4) typical for genus. Marginal and normal pore canals not seen. Duplicature not very wide, pronounced especially in postero-ventral part of valve. Line of concrescence parallel to outer margin. Vestibule not seen. Hinge (Pl. III, fig. 3b) like in *M. pedata*, but not so well developed.

Variation concerns the valve ornamentation at first. In some specimens a prickled ridge appears in postero-dorsal region of valve (Pl. IX, fig. 3) and thickened anterior margin is more distinctly incised in its middle portion. In others the sulcus is surrounded at the bottom by a distinct, rolle-like thickening. These features are absent in a type specimen of *M. howensis*. Surface generally spiny, but sometimes it bears well developed pits. Some specimens assigned here to *M. howensis* n.sp. somewhat resemble *M. hispida*, described by van Veen (1936) from Maastrichtian of south Limburg, however *M. howensis* differs in possessing marginal swelling on the anterior margin, while *M. hispida* has compressed anterior margin.

Occurrence. — Campanian of Miały⁵ (Belorussian SSR). In Poland: Campanian and Lower Maastrichtian of Mielnik.

Monoceratina starringi Bonnema, 1941

(Pl. III, fig. 1; X, fig. 8)

1941. *Monoceratina starringi* Bonnema; J. H. Bonnema, Ostracoden aus der Kreide..., p. 29, Pl. 6, fig. 63-68.
 1958. *Monoceratina starringi* Bonnema; H. V. Howe & L. Laurencich, Introduction to the study..., p. 420.

Material. — 1 left and 2 right valves damaged, from Lower Maastrichtian of Mielnik.

	(O.I/26) Left valve
Length	0.78
Height	0.31

Description. — Carapace solid, subtriangular, strongly elongate, length to height ratio as 2.5 : 1. Both valves of carapace similar in size, shape and ornamentation. Dorsal margin straight. Ventral margin nearly parallel to dorsal margin, slightly concave in middle. Anterior end broadly rounded. Posterior end acutely angulated, forming caudal process. Relief and valve ornamentation complicated. Median sulcus present, deepest in lower part. Valve bears two arcuate ribs below sulcus, ended posteriorly by moderately long, sharp spine. It has also a distinct node in front of sulcus and oblique rib behind sulcus in upper part of valve. Below postero-ventral spine there are two short supplementary ribs. At anterior margin there is a distinct, thick rib covering a longitudinal swelling, parallel to anterior margin. Small node on dorsal margin, posteriorly, is formed by a terminal hinge element, i.e. hinge ear. The most peripheral — anterior and posterior — parts of valve compressed. Duplicature wide, with pronounced vestibule at antero-ventral and postero-ventral margin, where eight straight marginal canals are visible. Normal pore canals not visible. Hinge (Pl. III, fig. 1) like in *M. pedata* (Marsson); terminal elements, i.e. dents in right valve small, but pronounced. Muscle scars obscured.

Remarks. — The illustration of *M. starringi* given by Bonnema (1941) as well as those of Howe (1958) are very indistinct, but the figured specimens in general outline resemble those of *M. starringi* from Poland.

Occurrence. — Upper Cretaceous (Maastrichtian?) of Holland and Campanian of Miały⁶ (Belorussian SSR). In Poland — Lower Maastrichtian of Mielnik.

⁵ *M. howensis* was found in comparative material from Miały.

⁶ Two specimens of *M. starringi* were found in comparative material from Miały.

Monoceratina longispina (Bosquet, 1854)

(Pl. III, fig. 5; XI, fig. 1)

1854. *Cythere longispina* Bosquet; J. Bosquet, Les crustacés fossiles..., p. 96, Pl. 6, fig. 7 a-d; *vide* F. B. Ellis & A. R. Messina, Catalogue of Ostracoda, vol. 15.
1880. *Cythere longispina* Bosquet; T. Marsson, Die Cirripedien und Ostracoden..., p. 44.
1941. *Monoceratina longispina* Bosquet; J. H. Bonnema, Ostracoden aus der Kreide..., p. 40, Pl. 6, fig. 69-76.
1958. *Monoceratina longispina* (Bosquet); H. V. Howe & L. Laurencich, Introduction to the study..., p. 410.

Material. — 6 right and 6 left valves, in most cases damaged, similar in size, from Lower Maastrichtian of Mielnik.

Dimensions (in mm.):

	(O.I/37) Right valve	(O.I/38) Left valve
Length	± 0.78	0.78
Height	0.42	0.44

Description. — Carapace thin, brittle, subovate, elongate, length to height ratio somewhat less than 2 : 1. Both valves very similar in size, shape and ornamentation. Dorsal margin straight, ventral margin slightly arched, more or less concave in middle. Anterior end broadly rounded, posterior somewhat angulated, arcuated in lower part. Valve considerably swollen, especially ventrally, forming there an overhanging outwards inflation. The most inflated ventral side, underlined by two semicircular ribs, ended posteriorly by a short, distinct spine. The most peripheral anterior and posterior part of the valve compressed. Median sulcus present. Surface smooth, except ventral side, covered by ribs parallel to ventral margin. Duplicature wide, forming a large vestibule at anterior and postero-ventral margin. Marginal and normal pore canals not visible. Hinge (Pl. III, fig. 5) of same type as in *M. bugensis* n.sp.

Muscle scars obscured, however four may be seen.

Remarks. — Some valves of *M. longispina*, described and illustrated by Bonnema, 1941, from Upper Cretaceous are reticulated and spined anteriorly in contrast to those from Luxemburg (Bosquet, 1854), Rügen (Marsson, 1880) and Poland. In Bonnema's opinion these last are smooth only because the ornamentation has disappeared, while in the opinion of the present writer the specimens from Upper Cretaceous of Holland assigned by Bonnema to *M. longispina* include more than one species.

Comparing the illustrations of *M. longispina* from Holland it seems that the right and left valves differ in shape and somewhat also in ornamentation, while in *M. longispina* from Poland both valves are almost identical. Moreover the right valve of *M. longispina* figured by Bonnema

(Pl. 6, fig. 69, 71) is similar to *M. bugensis* n.sp. from the Upper Cretaceous of Poland, where both valves are almost equal in shape and ornamentation. In Poland *M. longispina* occurs together with *M. bugensis* n.sp.

Occurrence. — Upper Cretaceous of Luxemburg, Maastrichtian of Rügen⁷, Maastrichtian (?) of Holland. In Poland — Lower Maastrichtian of Mielnik.

Monoceratina bugensis n.sp.

(Pl. IV, fig. 1-3; X, fig. 1-6)

Holotypus: Pl. IV, fig. 3; X, fig. 5 (O.I/46).

Stratum typicum: Lower Maastrichtian.

Locus typicus: Mielnik, Poland.

Derivatio nominis: *bugensis* — after the name of river Bug.

Diagnosis. — Carapace subovate, elongate, sharply ending posteriorly, considerably swollen, divided by median sulcus, with postero-ventral spine. Surface bears fine prickles, arranged subconcentrically on ventral side, and at antero-ventral margin.

Material. — 13 right and 9 left valves of different size from Lower Maastrichtian of Mielnik, 1 right valve from Lower Maastrichtian of Pamiętowo, 15 left and 12 right valves from Upper Maastrichtian of Bochothnica, Nasiłów and Kazimierz, almost equal in size. Valves in most cases damaged.

Dimensions (in mm.) of 10 specimens (5 right and 5 left valves):

	from Mielnik		from Bochothnica and Kazimierz	
	Right valve	Left valve	Right valve	Left valve
Length max.	0.84 (O.I/45)	0.81 (O.I/ 48)	0.75 (O.I/188)	0.75 (O.I/190)
Length min.	0.44 (O.I/43)	0.53 (O.I/187)	0.71 (O.I/189)	0.69 (O.I/191)
Height max.	0.47 (O.I/46)	0.44 (O.I/ 48)	0.37 (O.I/188)	0.37 (O.I/190)
Height min.	0.25 (O.I/43)	0.29 (O.I/187)	0.34 (O.I/189)	0.34 (O.I/191)

Description. — Carapace solid, subovate, elongate, length to height ratio in mature form as 2 : 1. Both valves similar in size, shape and ornamentation, however left valve has more truncated postero-ventral margin. Dorsal margin straight, ventral margin almost parallel, somewhat concave in middle. Anterior end broadly rounded, slightly truncated in upper part. Posterior end elongated, sharply angulated. Valve strongly swollen, especially frontally and at antero-ventral margin where it overhangs on the outside the ventral margin. The most distal, peripheral anterior and posterior part of valve compressed. Median sulcus present, bounded below and behind by short, but distinct, pointed spine. Surface

⁷ *M. longispina* was found in comparative material from Maastrichtian of Rügen.

of valve smooth except the flattened ventral side and frontal part, where there are fine prickles arranged in rows parallel to outer margin, bordering the valve swelling. Fine prickles occur generally at dorsal margin and sometimes along free margin.

Muscle scars (Pl. IV, fig. 2) typical for genus. Marginal and normal pore canals not visible. Duplicature wide, especially at antero-ventral margin forming there rather large vestibule. Line of concrescence parallel to outer margin.

Hinge of left valve (Pl. IV, fig. 1b) consists of median bar passing gradually into terminal sockets; anterior socket more distinct, posterior socket less distinct, forming hinge ears and passing directly into contact furrow. In right valve (Pl. IV, fig. 3) median furrow pass terminally into contact bar.

Variation concerns the size, shape and ornamentation of valves, representing different stages of ontogenetic development. Moreover the valves of *M. bugensis* are from different samples varying in age and facies thus giving rise to their different size and slightly different shape (cf. Pl. X, fig. 5, 6). Only in Mielnik, do young and mature forms occur together, while in Bochoznica, Kazimierz and Nasilów mature forms are exclusively found.

Valves of mature specimens of *M. bugensis* from Mielnik are bigger, more swollen and less elongated, compared with those from Bochoznica, Nasilów and Kazimierz.

Ontogeny. — In present writer's opinion the here described ontogenetical development based on right valves is represented by four last instars. Valves of the first three instars have not been found.

Instar IV — Dimensions (in mm.): length 0.44, height 0.25. Carapace subtriangular, without postero-ventral spine. Ornamentation very fine and indistinct. Duplicature and hinge obscured.

Instar V — Dimensions (in mm.): length 0.53, height 0.31. Valve more ovate, without spine, ornamentation more distinct. Short spines appear on dorsal side. Duplicature very narrow, hinge weakly differentiated.

Instar VI — Dimensions (in mm.): length 0.69, height 0.40. Valve similar to that in mature stage, bearing distinct spine and well developed ornamentation. Duplicature narrow, hinge almost as in next stage.

Instar VII (mature instar) — Dimensions (in mm.): length 0.84, height 0.47. All characters the best developed (cf. description).

Remarks. — *M. bugensis* is slightly similar to *M. longispina* (Bosquet, 1854) but has a more angulated outline, bearing prickles arranged in rows parallel to ventral margin on ventral side and parallel to anterior margin in frontal part of valve, whereas in *M. longispina* ornamentation consist of subconcentrical ribs on ventral side never visible in frontal part of valve. It is possible, that part of the specimens figured by Bonnema (1941)

and assigned by him to *M. longispina* in reality represent *M. bugensis* (see p. 388).

Occurrence. — Upper Cretaceous (Maastrichtian?) of Holland. In Poland — Lower Maastrichtian of Mielnik, Pamiętowo; Upper Maastrichtian of Bochońnica, Kazimierz and Nasiłów.

Monoceratina umbonata (Williamson, 1848)

(Pl. V, fig. 1-12; X, fig. 9-13; XI, fig. 3)

1848. *Cytherina umbonata* Williamson; *vide* T. R. Jones, 1849, A monograph..., p. 12.
 1849. *Cythere umbonata* Williamson; T. R. Jones, *Ibid.*, p. 12, Pl. 2, fig. 3 a-g.
 1880. *Cythere umbonata* (Will.); T. Marsson, Die Cirripeden und Ostracoden..., p. 45, Pl. 3, fig. 15 a-c.
 1890. *Cytheropteron umbonatum* (Williamson); T. R. Jones & G. J. Hinde, A supplementary monograph..., p. 40, Pl. 1, fig. 21-26.
 ?1900. *Cytheropteron umbonatum* Williamson; J. G. Egger, Foraminiferen und Ostracoden..., p. 185, Pl. 27, fig. 36, 37.
 non 1934. *Monoceratina umbonata* (Williamson); C. I. Alexander, Ostracoda..., p. 62, Pl. 8, fig. 9 a-b.
 1941. *Monoceratina umbonata* Williamson; J. H. Bonnema, Ostracoden aus der Kreide..., p. 29, Pl. 6, fig. 54-62.
 ?1952. *Monoceratina cf. umbonata* Williamson; A. Dupper, Ueber das Cenoman..., p. 106, Pl. 4, fig. 41.
 1958. *Monoceratina umbonata* (Williamson); H. V. Howe & L. Laurencich, Introduction to the study..., p. 424.

Material. — More than 200 left and right valves of different size from Campanian and Lower Maastrichtian of Mielnik, and 2 right valves from Lower Maastrichtian of Pamiętowo, sometimes damaged.

Dimensions of 100 specimens (in mm.):

	Right valve	Left valve
Length max.	0.75 (O.I/54)	0.76 (O.I/55)
Length min.	0.29 (O.I/50)	0.31 (O.I/184)
Height max.	0.38 (O.I/54)	0.40 (O.I/55)
Height min.	0.17 (O.I/50)	0.19 (O.I/184)

Description. — Carapace solid, ovate, elongate, length to height ratio in mature form as 2 : 1. Both valves similar in size and ornamentation. Postero-ventral margin in left valve generally more truncated than in right valve. Dorsal margin straight, ventral margin almost parallel, somewhat concave in middle. Anterior end broadly rounded. Posterior end angulated, slightly elongate, arched in lower part. Shell strongly inflated, especially frontally, divided by median sulcus. Behind and below sulcus a rather long, sharp spine appears. Anterior peripheral part of the shell considerably swollen. The most distal posterior part compressed. Margins of valve rimmed, being double dorsally and anteriorly. Surface covered by numerous prickles arranged concentrically at ventral side and on frontal part of the valve; back and frontal part usually reticulated dorsally.

Muscle scars (Pl. V, fig. 2) typical for genus. Marginal and normal pore canals not seen. Duplicature as a rule wide, especially at postero-ventral margin, forming there a distinct, large vestibule, not always preserved.

Hinge (Pl. V, fig. 1) as *M. bugensis* n.sp.

Variation concerns the size, shape and ornamentation of valve representing different instars (Pl. XII, fig. 1-6). Shape of valves vary even within the same, young or mature, instars (Pl. V, fig. 3-12).

Ontogeny. — It appears from the graph of length to height ratio based on 100 specimens (right valves) (Fig. 5) and the Przi bram-Brooks law, that the specimens of *M. umbonata* belong to five out of seven instars which represent a complete ontogenetic development.

Instar III — Dimensions (in mm.): length 0.29, height 0.17. Outline ovate; ventral margin more oblique and less concave in the middle than in the succeeding instars. Postero-ventral spine short. Anterior peripheral part of the valve compressed. Ornamentation very weak and marked only frontally. Duplicature and hinge not distinct.

Instar IV — Dimensions (in mm.): length 0.39, height 0.22. Valve similar to the preceding, younger instar, but medially with more concave ventral margin. Duplicature and hinge not distinct.

Instar V — Dimensions (in mm.): length 0.50, height 0.28. Shell rather similar to that of mature specimen, with long postero-ventral spine, well developed ornamentation, but lacking peripheral swelling at anterior margin. Duplicature narrow, hinge weakly differentiated.

Instar VI — Dimensions (in mm): length 0.61, height 0.34. Shell similar to that of mature specimens, peripheral frontal swelling absent. Duplicature narrow, hinge weakly differentiated, similar to the next instar.

Instar VII (mature instar) — Dimensions (in mm): length 0.75, height 0.37. All features well developed (cf. description). This instar represents a supposedly mature form.

Remarks. — Egger (1900) described *Cytheropteron umbonatum* (recte *Monoceratina umbonata*) from Upper Cretaceous of Germany. Description and illustrations of specimens assigned to this species are not clear, and that is why they are assigned tentatively by the present author to *M. umbonata* only. *M. umbonata*, as described by Alexander (1934) from Upper Cretaceous (Taylor and Navarro formations) of Texas, differs in shape, relief and ornamentation of valve from specimens, assigned to this species from Europe, and in the present author's opinion is not conspecific with those from Europe. Dupper (1952) figured (Pl. 4, fig. 41) a specimen, identified as *M. cf. umbonata*, from the Cenomanian of Germany. Judging from this illustration, the specimen figured by him represents a different species.

Occurrence. — Upper Cretaceous of England, Maastrichtian of Rügen⁸, Upper Cretaceous (Maastrichtian?) of Holland and Campanian of Miały⁹ (Belorussian SSR). In Poland — Campanian and Lower Maastrichtian of Mielnik and Lower Maastrichtian of Pamiętowo.

Monoceratina cf. *umbonata* (Williamson, 1848)

(Pl. X, fig. 7)

In Campanian of Mielnik some small, rare specimens, similar to young specimens of *M. umbonata* (Williamson) occur with *M. umbonata*. Compared with mature specimen of *M. umbonata* they are more angulated in outline, less swollen, without swelling at anterior margin, and more strongly, irregularly spiny. In contrast to the young specimens of *M. umbonata*, they lack a compressed, rounded anterior margin. It seems that these forms represent subspecies of *M. umbonata* or a separate species related to *M. umbonata*. The small number of specimens does not allow the author to describe them as belonging to a new species.

Monoceratina acanthoptera (Marsson, 1880)

(Pl. VI, fig. 1 a-b; IX, fig. 7, 8)

1880. *Cythere acanthoptera* Marsson; T. Marsson, Die Cirripeden und Ostracoden..., p. 45, pl. 3, fig. 14 a-c.
 non 1934. *Monoceratina acanthoptera* (Marsson); C. I. Alexander, Ostracoda..., p. 61, pl. 8, fig. 6 a-b.
 1958. *Monoceratina acanthoptera* (Marsson); H. V. Howe & L. Laurencich, Introduction to the study..., p. 402.

Material. — 3 right and 6 left valves, similar in size, from Lower Maastrichtian of Pamiętowo.

Dimensions (in mm.):

	(O.I/66) Right valve	(O.I/77) Left valve
Length	0.56	0.53
Height	0.31	0.28

Description. — Carapace solid, subquadrate, elongate, length to height ratio as 2 : 1. Both valves similar in size, shape and ornamentation, although right valve is more angulated posteriorly. Dorsal margin straight, parallel to ventral margin. Anterior end rounded, posterior end rounded with lower part arcuately truncated. Valve swollen, especially frontally and along ventral margin, divided by a faint median sulcus. Ventral side and the most peripheral admarginal and anterior posterior parts of valve compressed. Swelling at ventral margin-like alar prolon-

^{8,9} *M. umbonata* was found in comparative material from Maastrichtian of Rügen, and from Campanian of Miały.

gation — ending posteriorly in a short, sharp spine. Surface smooth, except ventral side which bears some ribs, parallel to the outer margin.

Muscle scars indistinct. Marginal and normal pore canals not visible. Duplicature wide, forming narrow vestibule at antero-ventral and postero-ventral margin. Hinge like in *M. pedata*, with small, distinct terminal dents in hinge of right valve (Pl. VI, fig. 1a).

Remarks. — Specimens of *Cythere acanthoptera* (recte *M. acanthoptera*), described by Marsson (1880) from Upper Cretaceous of Rügen, are very similar to *M. acanthoptera* from Lower Maastrichtian of Poland. Alexander (1934) recorded the presence of *M. acanthoptera* in Upper Cretaceous (Taylor and Austin formations) of Texas. The specimen described by him differs from those from Europe by having a different outline and valve relief. *M. acanthoptera* from Cretaceous of Texas is ovate, with well pronounced median sulcus and with strong swelling which does not hide ventral margin, whereas European specimens of *M. acanthoptera* are rather subquadrate in outline with a faint median sulcus, moreover their swelling hides conspicuous part of ventral margin. In the present writer's opinion the American forms are not conspecific with European specimens.

Marsson (1880) comparing *M. acanthoptera* with *M. longispina* stated, that these two species differ in the size of valves and in the presence of distinct, longitudinal ribs on ventral side in *M. longispina*, which are lacking in *M. acanthoptera*. This difference in fact is not the case, as similar ribs occur in *M. acanthoptera*, however on the flattened ventral side, and consequently are not visible in the lateral view. The differences between the species in question concern mainly the shape of valves. In *M. acanthoptera* the lateral swelling, pointing posteriorly, overhangs in lower part the ventral margin hiding it, whereas in *M. longispina* the lateral swelling does not obscure the ventral margin, which is not flattened ventrally. The spine in *M. longispina* occurs in the postero-ventral part of valve. Moreover *M. acanthoptera* is angulated in outline, while *M. longispina* is almost ovate.

Occurrence. — Upper Cretaceous (Maastrichtian) of Rügen.¹⁰ In Poland: Lower Maastrichtian of Pamiętowo.

Monoceratina tuberosa n.sp.

(Pl. VI, fig. 2 a-b, 3; IX, fig. 5, 6)

Holotypus: Pl. IX, fig. 5 (O.I/69).

Stratum typicum: Lower Maastrichtian.

Locus typicus: Pamiętowo, Poland.

Derivatio nominis: *tuberosa* — Lat. *tuber* = hump, covered with large humps.

¹⁰ *M. acanthoptera* was found in comparative material from Maastrichtian of Rügen.

Diagnosis. — Carapace subrhomboidal, elongate, with pronounced, deep median sulcus, bordered by two irregular swellings in front, and bulbous node ending with short, sharp tubercle behind sulcus. Others irregular humps are near back of dorsal margin. Both ends of valve compressed.

Material. — 11 right and 3 left valves, in many cases damaged, similar in size, from Lower Maastrichtian of Pamiętowo.

Dimensions (in mm.):

	(O.I/69) Right valve	(O.I/70) Left valve
Length	0.55	0.55
Height	0.29	0.28

Description. — Carapace solid, subrhomboidal, elongate, length to height ratio as 2 · 1. Both valves are similar in size, shape and ornamentation. Dorsal margin straight, ventral margin subparallel, slightly concave in middle. Anterior end obliquely rounded, posterior more obliquely rounded, slightly elongate. The valve considerably swollen in front, where it forms two irregular swellings and at back of ventral margins, forming there a bulbous node ended by a short, sharp prickle. Near back of dorsal margin there are two irregular, slightly oblique folds. Median sulcus well developed. Both ends of valve compressed.

Muscle scars indistinct. Only three muscle scars are visible, although field of muscle scars is large. Marginal and normal pore canals not visible. Duplicature narrow, distinct especially posteriorly, where forms a distinct vestibule. Hinge type like in *M. pedata* (Pl. VI, fig. 2 a, 3).

Remarks. — *M. tuberosa* n.sp. somewhat resembles *M. parva* Veen, 1936, especially from above, but *M. parva* has different relief of frontal part of valve and it is punctuated or reticulated, whereas *M. tuberosa* is smooth.

Occurrence. — Lower Maastrichtian of Pamiętowo, Poland.

Monoceratina strangulata (Bosquet, 1854)

(Pl. VI, fig. 4, 5; IX, fig. 4)

1854. *Cythere strangulata* Bosquet; J. Bosquet, *Les Crustacés fossiles...*, p. 94, Pl. 6, fig. 5 a-d (*vide* B. F. Ellis & A. R. Messina, *Catalogue of Ostracoda*, vol. 15).
1933. *Monoceratina strangulata* Bosquet; J. E. van Veen, *Die Ostracoden...*, p. 10, Pl. 2, fig. 26—29.
1958. *Monoceratina strangulata* (Bosquet); H. V. Hove & L. Laurencich, *Introduction to the study...*, p. 421.

Material. — 3 left valves, almost the same in size, from Lower Paleocene of Pamiętowo.

Dimensions (in mm.):

	(O.I/39) Left valve
Length	0.56
Height	0.28

Description. — Carapace ovate, elongate, length to height ratio less than 2 : 1. The description applies only to the left valve, the right being not found. Dorsal margin straight, ventral margin parallel. Anterior end rounded, posterior end obliquely rounded. All carapace, except distal parts, considerably swollen, divided by median sulcus. Posteriorly, below sulcus, an elongated, rounded swelling. The most distal anterior, dorsal and posterior part of valve compressed. Surface of valve rough, having fine prickles arranged irregularly.

Muscle scars not visible. Normal and marginal pore canals not seen. Duplicature narrow, forming narrow vestibule anteriorly and posteriorly. Line of concrescence parallel to outer margin. Hinge (Pl. VI, fig. 4) like in *M. bugensis*.

Occurrence. — Maastrichtian of Limburg. In Poland: Lower Paleocene of Pamiętowo.

Monoceratina flata n.sp.

(Pl. VI, fig. 6; VII, fig. 1—3; XI, fig. 5, 11)

Holotypus: Pl. VII, fig. 1; XI, fig. 5 (O.I/63).

Stratum typicum: Lower Maastrichtian.

Locus typicus: Pamiętowo, Poland.

Derivatio nominis: *flata* — Lat. *flatus* = blown, swelled on account of the inflated shape of the valve.

Diagnosis. — Carapace ovately rhomboidal, elongate, strongly inflated, with a median sulcus. Alar inflation in postero-ventral part of valve. Ventral side flattened. The surface of valve covered by numerous prickles, arranged in concentric rows in frontal part and on ventral side; posterior and antero-dorsal part reticulated.

Material. — 13 right and 14 left valves, in the most cases damaged, similar in size, from Lower Maastrichtian of Pamiętowo.

Dimensions (in mm.):

	(O.I/63) Right valve	(O.I/64) Left valve
Length	0.75	0.72
Height	0.41	0.40

Description. — Carapace solid, ovately rhomboidal, elongate, length to height ratio somewhat less than 2 : 1. Both valves similar in size, shape and ornamentation. Dorsal and ventral margins straight, parallel. Anterior end rounded, truncated in upper part. Posterior end slightly rounded,

somewhat elongate. Almost all the carapace — except the most peripheral anterior and posterior parts — distinctly inflated, divided by median sulcus. Upper and lower part of sulcus furrow-like. The greatest inflation of valve is in the postero-ventral part, where it looks like alar inflation. The ventral part of valve flattened. Surface covered by numerous prickles, arranged in concentric rows in frontal part of valve and on ventral side; posterior and antero-dorsal part reticulated.

Muscle scars (Pl. VII, fig. 3) typical for genus. Normal pore canals (Pl. VI, fig. 6) not numerous, irregularly arranged. Marginal canals obscured. Duplicature not very wide, distinct especially at postero-ventral and at postero-dorsal margin; a small vestibule present in anterior part. Line of concrescence parallel to outer margin. Hinge (Pl. VII, fig. 2) like in *M. bugensis*.

Remarks. — Shape and ornamentation of *M. flata* differs greatly from those described in other species assigned to that genus.

Occurrence. — Lower Maastrichtian of Pamiętowo, Poland.

Monoceratina brevispina n.sp.

(Pl. VII, fig. 6-8; XI, fig. 9)

Holotypus: Pl. VII, fig. 8; XI, fig. 9 (O.I/61).

Stratum typicum: Lower Maastrichtian.

Locus typicus: Pamiętowo, Poland.

Derivatio nominis: *brevispina* — Lat. *brevis* = short, *spina* = spine, provided with a short spine in postero-ventral part of the valve.

Diagnosis. — Carapace subovate, elongate, strongly inflated, with weakly marked median sulcus, and tubercle-like, very short spine in postero-ventral part. Surface covered by numerous, fine prickles, forming indistinct reticulation.

Material. — 5 left valves and 1 right valve, often damaged, from Lower Maastrichtian of Pamiętowo.

Dimensions (in mm.):

	(O.I/61) Right valve	(O.I/60) Left valve
Length	0.81	0.84
Height	±0.40	0.45

Description. — A solid, ovate, elongate carapace, length to height ratio somewhat less than 2 : 1. Both valves of carapace similar in size, shape and ornamentation. Dorsal margin straight, parallel to ventral margin. Anterior end rounded, slightly truncated in upper part. Posterior end less rounded, slightly elongate. Valves considerably swollen, except the most peripheral posterior and anterior parts, divided by faint median sulcus, and tubercle-like spine behind. Surface of the valve covered by

numerous, fine prickles forming indistinct reticulation, and weakly marked concentrical rims on the flattened ventral side.

Muscle scars (Pl. VII, fig. 7) like in the other here described species. Marginal and normal pore canals not visible. Duplicature wide, well developed, the largest in anterior part of the valve, where it may form a large vestibule. Line of concrescence parallel to outer margin. Hinge (Pl. VII, fig. 8) like in *M. bugensis* n.sp.

Variation. — The valves of *M. brevispina* are of various shape. There are relatively long and low valves, in contrast with rather short and high. It is possible that above mentioned differences are connected with sexual dimorphism (cf. variation of *M. crassa* n.sp.).

Remarks. — *M. brevispina* n.sp. is similar to *M. crassa* n.sp., differing from it by the presence of a tubercle-like spine in postero-ventral part of the valve (cf. remarks on *M. crassa*, p. 399). *M. brevispina* is also somewhat similar to *M. umbonata* (Williamson), occurring in Campanian and Lower Maastrichtian of Mielnik, however *M. umbonata* is generally smaller, has a long sharp spine in postero-ventral part of valve and inflated, separated anterior margin. In *M. umbonata* the posterior part of the valve is more elongated and angulated, whereas it is rounded in *M. brevispina*.

Occurrence. — Lower Maastrichtian of Pamieutowo, Poland.

Monoceratina crassa n.sp.
(Pl. VII, fig. 4, 5; XI, fig. 2, 6-8)

Holotypus: Pl. XI, fig. 6 (O.I/73).

Stratum typicum: Lower Maastrichtian.

Locus typicus: Pamieutowo, Poland.

Derivatio nominis: *crassa* — Lat. *crassus* = thick, named after the shape of valve.

Diagnosis. — Carapace ovate, elongate, strongly inflated, with median sulcus. The most peripheral part of valve compressed. Surface covered by numerous, fine prickles forming indistinct reticulation.

Material. — 11 left and 4 right valves, in many cases damaged, similar in size, from lower Maastrichtian of Pamieutowo.

Dimensions (in mm.):

	(O.I/73) Right valve	(O.I/75) Left valve
Length	0.81	0.81
Height	0.50	0.47

Description. — A solid, ovate, elongate carapace, length to height ratio less than 2 : 1. Both valves of carapace similar in size, shape and ornamentation, although right valve in many cases is somewhat higher,

than left one. Dorsal margin straight, parallel to ventral margin. Ventral margin somewhat concave in middle. Anterior end rounded, in upper part slightly truncated. Posterior end less rounded. Valve strongly swollen, except the most peripheral parts along free margin. Posterior part more swollen than the anterior. Furrow-like median sulcus weakly developed, but distinct. Surface of valve rough, having numerous, fine prickles, forming indistinct reticulation; on ventral side prickles arranged concentrically.

Muscle scars (Pl. VII, fig. 4b) typical for genus. Normal and marginal pore canals obscured. Duplication rather narrow, forming a small vestibule in antero-ventral and postero-ventral part of valve. Type of hinge (Pl. VII, fig. 5; XI, fig. 2) like in *M. bugensis* n.sp.

Variation. — The valves of *M. crassa* n.sp. are of various shape. Extreme examples of this are the two illustrated specimens (Pl. XIII, fig. 4, 5); one being long, low and less inflated posteriorly than the other, which is rather short, high and more swollen posteriorly. It is possible that they represent two forms sexually different.

Remarks. — *M. crassa* n.sp. is very similar to *M. brevispina* n.sp. from Lower Maastrichtian of Pamiętowo. The only difference being the absence of the tubercle in postero-ventral part of valve in *M. crassa*, which is a characteristic feature of *M. brevispina*. *M. crassa* is also similar to *Cytheropteron sherborni* (recte *M. sherborni*) Jones & Hinde, 1890, from Cretaceous of England. Outline of valve is similar, but *M. sherborni* has a more distinct and deeper concavity between the posterior periphery and posterior inflation of valve. In *M. crassa* the inflation of the carapace in posterior part disappear gradually towards the margin. In *M. crassa* ventral margin is uncovered, whereas in *M. sherborni* it is hidden by valve inflation.

Occurrence. — Lower Maastrichtian of Pamiętowo, Poland.

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Warszawa, March 1964

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JANINA SZCZUCHURA

MONOCERATINA ROTH (OSTRACODA) Z GÓRNEJ KREDY
I DOLNEGO PALEOCENU POLSKI PÓŁNOCNEJ I ŚRODKOWEJ

Streszczenie

W pracy niniejszej opisano 17 gatunków należących do rodzaju *Monoceratina* Roth, w tym 9 nowych, i 1 nowy podgatunek. Ustanowiono także nową podrodzinę Monoceratininae, włączoną z zastrzeżeniem do Bythocytheridae G. O. Sars. Przeprowadzono analizę zmienności indywidualnej, rozwoju ontogenetycznego i rozprzeszczenia zbadanych gatunków *Monoceratina* z kredy (kampan, mastrycht) i z dolnego paleocenu Polski.

Materiał pochodzi z 2 wierceń (Pamiętowo, Sochaczew) i z 4 odkrywek (Mielnik, Kazimierz, Bochotnica, Nasilów), których charakterystyka stratygraficzno-litologiczna podana jest na str. 358.

Opisano następujące gatunki *Monoceratina*: *Monoceratina pedata* (Marsson, 1880), *M. compacta* n.sp., *M. mielnicensis* n.sp., *M. polonica* n.sp., *M. laevioides laevioides* Bonnema, 1941, *M. laevioides similis* n.subsp., *M. montuosa* (Jones, 1875), *M. howensis* n.sp., *M. staringi* Bonnema, 1941, *M. longispina* (Bosquet, 1854), *M. bugensis* n.sp., *M. umbonata* (Williamson, 1848), *M. cf. umbonata* (Williamson, 1848), *M. acanthoptera* (Marsson, 1880), *M. tuberosa* n.sp., *M. strangulata* (Bosquet, 1854), *M. flata* n.sp., *M. brevispina* n.sp. i *M. crassa* n.sp. Rozprzeszczenie wymienionych gatunków w górnej kredzie i w dolnym paleocenie Polski (tabela 1) wskazuje, iż tworzą one dwa odmienne zespoły faunistyczne, charakterystyczne dla określonych facji. W facji kredy piszącej i w marglach dominują gatunki już znane, opisane z podobnych facji, natomiast w utworach wapiennych przeważają gatunki nowe. Obydwu zespołom gatunków *Monoceratina* towarzyszy nieco inny zespół ostrakodów. W utworach piaszczysto-wapiennych (Sochaczew) *Monoceratina* w ogóle nie znaleziono. Nadto zauważono, że wielkość skorupki tego samego gatunku zmienia się w zależności od facji, w której zostały znalezione, i że tylko w niektórych próbach występują osobniki młodociane określonych gatunków.

W wyniku analizy rozprzestrzenienia opisanych w niniejszej pracy gatunków *Monoceratina* stwierdzono, że są one ograniczone do poziomów górnej kredy Europy (tabela 2), w przeciwieństwie do dotychczasowych poglądów o ich szerszym zasięgu geograficznym (Ameryka Płn., azjatycka część Z.S.R.R.).

Ogółem autorka wybrała ponad 500 skorupek należących do *Monoceratina*, w tym wiele skorupek osobników młodocianych. Wydzielone gatunki wykazują znaczną zmienność zarysu, rzeźby i ornamentacji skorupki, u wszystkich jednak stwierdzono prosty brzeg dorsalny, mniej lub więcej wydłużony tylny koniec skorupki, sulcus i wyraźną duplikaturę. U większości gatunków wykształca się wyraźne westibulum i widoczne są odciski mięśniowe (5), ułożone w nieco łukowaty szereg w obrębie sulcusa. Zawias jest zmodyfikowanym typem adontowym lub lofodontowym, z wyraźnymi uszkami zawiasowymi obrzeżającymi zawias lewej skorupki. Normalne kanaliki porowe zwykle niewidoczne, u *M. flata* n.sp. nieregularnie, rzadko ułożone. Kanaliki radialne widoczne tylko u *M. pedata* (Marsson), proste i nieliczne. U *M. umbonata* (Williamson) i *M. laevioides laevioides* Bonnema wyróżnia się 5 stadiów rozwoju ontogenetycznego, przy czym już w obrębie młodocianych osobników *M. umbonata* zaznacza się wyraźny dymorfizm polegający na różnym stosunku długości do wysokości skorupki (Pl. V, fig. 3-12). Dymorfizm, przypuszczalnie płciowy, zaznacza się także u *M. crassa* n.sp., gdzie oprócz wyżej wymienionych różnic istnieje zróżnicowanie szerokości skorupki, tj. jedno (samic) są bardziej wydęte w części tylnej, drugie (samców) są mniej wydęte.

Rodzaj *Monoceratina* ustanowiony został na podstawie gatunku *Monoceratina ventrale* (recte *M. ventralis ventralis*) i *M. ventrale magnum* (recte *M. ventralis magnum*), z karbonu Oklahomy, przez Rotha (1928). Później opisano liczne gatunki tego rodzaju z Europy, Ameryki Płn. i Azji, zarówno z paleozoiku, mezozoiku, jak i kenozoiku. Pozycja systematyczna tego rodzaju zmieniała się często ze względu na brak dostatecznej znajomości cech morfologicznych gatunków zaliczanych do tego rodzaju, bądź ze względu na ich różnie traktowaną hierarchię. *Monoceratina* zaliczano do różnych rodzin (Primitiidae, Beyrichiidae, Acronotellidae, Cytheridae, Paradoxostomidae i in.), a więc i do różnych podrzędów (Paleocopa, Podocopa); często inaczej klasyfikowano gatunki paleozoiczne, inaczej zaś — młodsze, zaliczane do tego rodzaju. Najnowsze publikacje są na ogół zgodne co do tego, że *Monoceratina* należy do Podocopa G. O. Sars, 1866 (Podocopina emend. Swain, 1961), do Cytheridae Baird, 1850 (Cytheracea emend. Ulrich & Bassler, 1923), do Bythocytherinae G. O. Sars, 1926 (Bythocytheridae emend. Sylvester-Bradley, 1961).

Zdaniem autorki, paleozoiczne i po-paleozoiczne gatunki zaliczone do *Monoceratina* są kongeneryczne, a rodzaj *Monoceratina* niewątpliwie reprezentuje podrząd Podocopa, nadrodzinę Cytheracea i, z zastrzeżeniem, rodzinę Bythocytheridae. Autorka utworzyła nową podrodzinę Monoceratininae, do której — poza *Monoceratina* — włączyła: *Triceratina* Upson, 1933 (z zastrzeżeniem), *Neomonoceratina* Kingma, 1948 (z zastrzeżeniem), *Bythoceratina* Hornibrook, 1953, i *Miracythere* Hornibrook, 1953.

Za cechy diagnostyczne podrodziny autorka uważa typ odcisków mięśniowych (ilość i układ), wykształcenie brzegu zawiasowego, kształt skorupki oraz wykształ-

cenie wolnego brzegu. Podstawą dla utworzenia nowej podrodziny są różnice w wykształceniu wyżej wspomnianych cech morfologicznych skorupki u *Monoceratina*, stwierdzone u gatunków z kredy polskiej i u *Bythocythere turgida* Sars (Sylvester-Bradley, 1947), tj. gatunku typowego dla *Bythocythere*, od którego wywodzi się podrodzina *Bythocytherinae* i do której najczęściej zaliczana jest *Monoceratina*.

ЯНИНА ЩЕХУРА

MONOCERATINA ROTH (OSTRACODA) ИЗ ВЕРХНЕГО МЕЛА И НИЖНЕГО
ПАЛЕОЦЕНА СЕВЕРНОЙ И ЦЕНТРАЛЬНОЙ ПОЛЬШИ

Резюме

В настоящей работе описано 17 видов рода *Monoceratina* Roth, в том числе 9 новых, и 1 новый подвид. Установлено тоже новое подсемейство *Monoceratinae*, причисленное условно к *Bythocytheridae* G. O. Sars. Проведен анализ индивидуальной изменчивости, онтогенетического развития и распространения изученных видов *Monoceratina* из мела (кампан, мастрихт) и нижнего палеоцена Польши.

Материалы происходят из 2 бурений (Паментово, Сохачев) и из 4 обнажений (Мельник, Казимерж, Бохотница, Насилув), которых стратиграфическая и литологическая характеристики даны на стр.

Описано следующие виды: *Monoceratina pedata* (Marsson, 1880), *M. compacta* n. sp., *M. mielnicensis* n. sp., *M. polonica* n. sp., *M. laevioides loevioides* Bonnema, 1941, *M. laevioides similis* n. subsp., *M. montuosa* (Jones, 1875), *M. howensis* n. sp., *M. staringi* Bonnema, 1941, *M. longispina* (Bosquet, 1854), *M. bugensis* n. sp., *M. umbonata* (Williamson, 1848), *M. cf. umbonata* (Williamson, 1848), *M. acanthoptera* (Marsson, 1880), *M. tuberosa* n. sp., *M. strangulata* (Bosquet, 1854), *M. flata* n. sp., *M. brevispina* n. sp., и *M. crassa* n. sp. Распространение перечисленных видов в верхнем мелу и нижнем палеоцене Польши (табл. 1) показывает, что они образуют два разных фаунистических комплекса, которые являются характерными для определенных фаций. В фации пишущего мела и в мергелях преобладают известные уже виды, описанные из сходных фаций, в то время как в известняках доминируют новые виды. Обоим комплексам видов *Monoceratina* сопутствуют несколько иные комплексы остракод. В песчанисто-известняковых отложениях (Сохачев) вообще *Monoceratina* не найдены. Кроме того замечено, что величина створок одного и того же вида изменяется в зависимости от фации, в которой они найдены, и что только в некоторых пробах встречаются молодые особи определенных видов.

В результате анализа распространения описанных в настоящей работе видов *Monoceratina* установлено, что они ограничиваются к горизонтам верхнего мела Европы (табл. 2), вопреки существующему до сих пор мнению об их более широком географическом распространении (Северная Америка, азиатская часть СССР).

Автор выбрал больше 500 створок *Monoceratina*, в том числе много створок молодых особей. Выделенные виды обнаруживают большую изменчивость очертаний, скульптуры и орнаментации створок. Однако у всех установлено присутствие прямого спинного края, более или менее удлиненного заднего конца створки, желобка и отчетливой дубликатуры. У большинства видов образуется отчетливое vestibulum и видны мускульные отпечатки (5), расположенные несколько наклонными рядами в пределах желобка. Замок — это модифицированный тип, адонтный или лододонтный, с отчетливыми замковыми ушками окаймляющими замок левой створки. Нормальные поровые каналы обычно незаметны, у *M. flata* n. sp. расположенные редко и нерегулярно. Радиальные каналы заметны только у *M. pedata* (Marsson), прямые и немногочисленные. У *M. umbonata* (Williamsson) и у *M. laevioides laevioides* Bonnema выделяется 5 стадий онтогенетического развития, причём уже в пределах молодых особей *M. umbonata* намечается отчетливый диморфизм, выраженный в разном соотношении длины к высоте створки (пл. V, фиг. 3—12). Диморфизм, по всей вероятности половой, существует тоже у *M. crassa* n. sp., где, кроме выше перечисленных различий, имеется дифференциация ширины створок, т. е. одни (самки) являются более вздутыми, другие (самцы) менее вздуты в задней части.

Род *Monoceratina* установлен Ротом (Roth) в 1938 году на основании вида *Monoceratina ventrale* (recte *M. ventralis ventralis*) и *M. ventrale magnum* (recte *M. ventralis magnum*) из каменноугольного периода Oklahoma. Позже описано многочисленных видов этого рода из палеозоя, мезозоя и кайнозоя Европы, Северной Америки и Азии. Систематическое положение этого рода менялось часто в связи с недостаточным знанием морфологических признаков видов, причисленных к этому роду, или же в виду разной трактовки их иерархии. *Monoceratina* были причисляемы к разным семействам (Primitiidae, Beyrichiidae, Acronotellidae, Cytheridae, Paradoxostomidae и другие), а тем образом и к разным подотрядам (Paleosora, Podosora). Часто иначе классифицировались палеозойские виды, а иначе младшие, причисляемые к этому роду. Авторы новейших работ согласны относительно того, что *Monoceratina* принадлежит Podosora G. O. Sars, 1866 (Podocopina emend. Swain, 1961), Cytheridae Baird, 1850 (Cytheracea emend. Ulrich & Bassler, 1923), Bythocytherinae G. O. Sars, 1926 (Bythocytheridae emend. Sylvester-Bradley, 1961).

По мнению автора, палеозойские и послепалеозойские виды, причисленные к *Monoceratina*, являются конгенерическими, а род *Monoceratina* является несомненно представителем подотряда Podosora, надсемейства Cytheracea и, с некоторой оговоркой, семейства Bythocytheridae. Автор установил новое подсемейство Monoceratininae, в которое, кроме *Monoceratina*, включает *Triceratina*

Upson, 1933 (условно), *Neomonoceratina* Kingma, 1948 (условно), *Bythoceratina* Hornibrook, 1953, и *Miracythere* Hornibrook, 1953.

Согласно мнению автора, диагностическими признаками подсемейства являются: тип мускульных отпечатков (количество, расположение), форма замкового края створки и свободного края. Новое подсемейство установлено на основании различий в форме выше упомянутых морфологических признаков створки у *Monoceratina*, установленных при сопоставлении видов из польского мела с *Bythocythere turgida* Sars (Sylvester-Bradley, 1947), т. е. с типовым видом *Bythocythere*, от которого ведет свою родословную подсемейство *Bythocytherinae*, и к которому чаще всего причисляют *Monoceratina*.

PLATES

Plate I

Monoceratina polonica n.sp.

Fig. 1. Right valve (O.I/4); *a* inside view, *b* dorsal view, *c* muscle scars.

Monoceratina pedata (Marsson)

Fig. 2. Right valve (O.I/1); *a* inside view, *b* dorsal view.

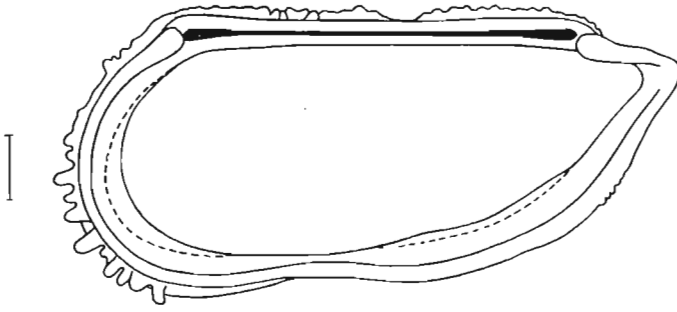
Fig. 3. Left valve (O.I/3); muscle scars.

Monoceratina compacta n.sp.

Fig. 4. Left valve (O.I/7); hinge margin.

Fig. 5. Left valve (O.I/8); muscle scars.

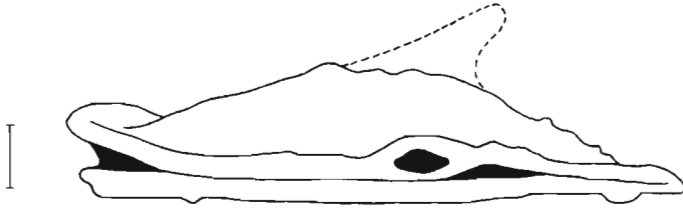
All scales correspond to 0.1 mm.



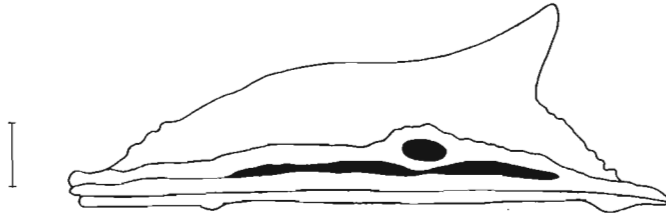
1a



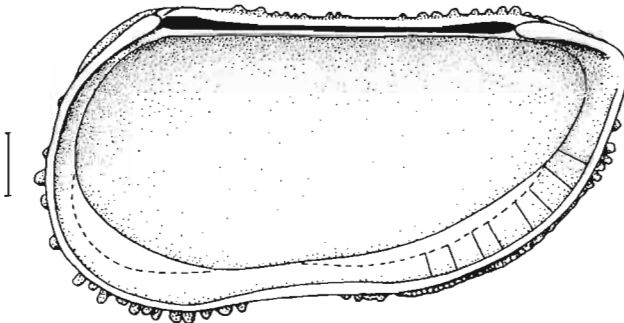
1c



1b



2b



2a



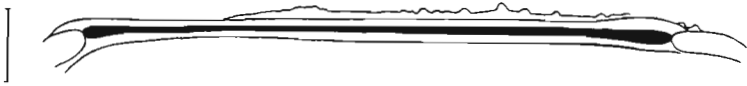
3



4



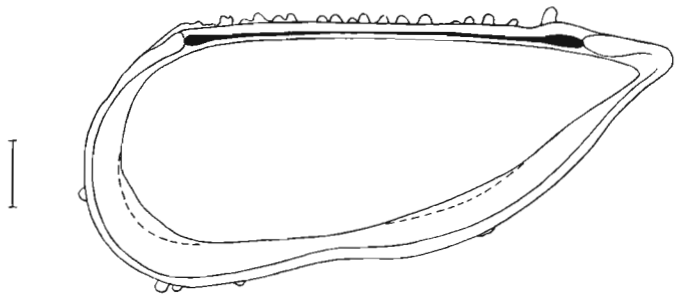
5



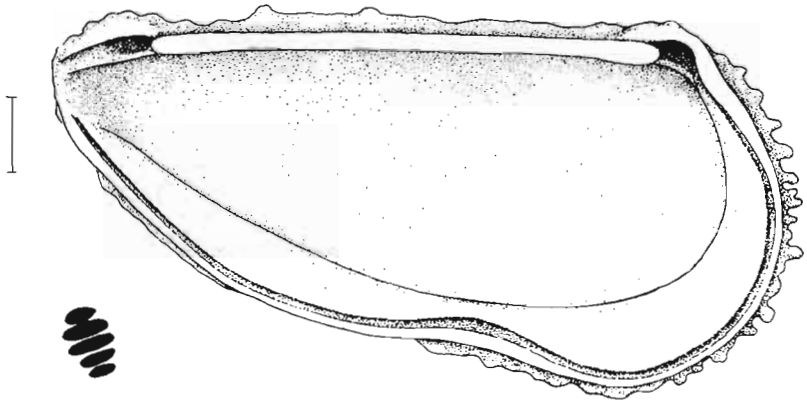
1



2a



2b



4

3

Plate II

Monoceratina laevioides similis n.subsp.

Fig. 1. Right valve (O.I/20); hinge margin.

Monoceratina mielnicensis n.sp.

Fig. 2. Right valve (O.I/14); a dorsal view, b inside view.

Fig. 3. Left valve (O.I/15); inside view.

Fig. 4. Left valve (O.I/13); muscle scars.

Plate III

Monoceratina staringi Bonnema

Fig. 1. Left valve (O.I/27); hinge margin.

Monoceratina montuosa (Jones)

Fig. 2. Left valve (O.I/36); hinge margin.

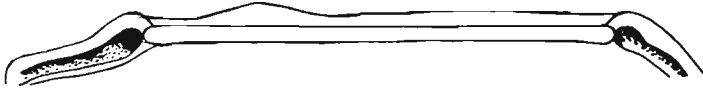
Monoceratina howensis n.sp.

Fig. 3. Left valve (O.I/29); a dorsal view, b hinge margin.

Fig. 4. Left valve (O.I/32); muscle scars.

Monoceratina longispina (Bosquet)

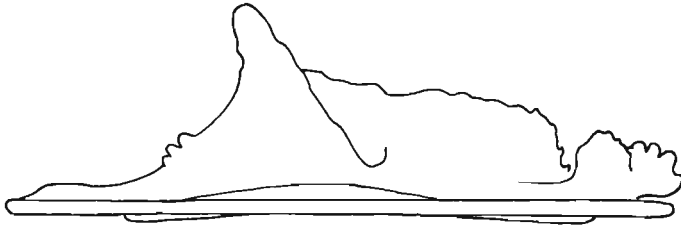
Fig. 5. Left valve (O.I/38); hinge margin.



1



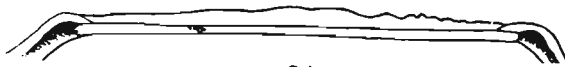
2



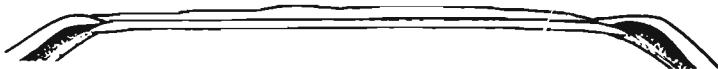
3a



4



3b



5

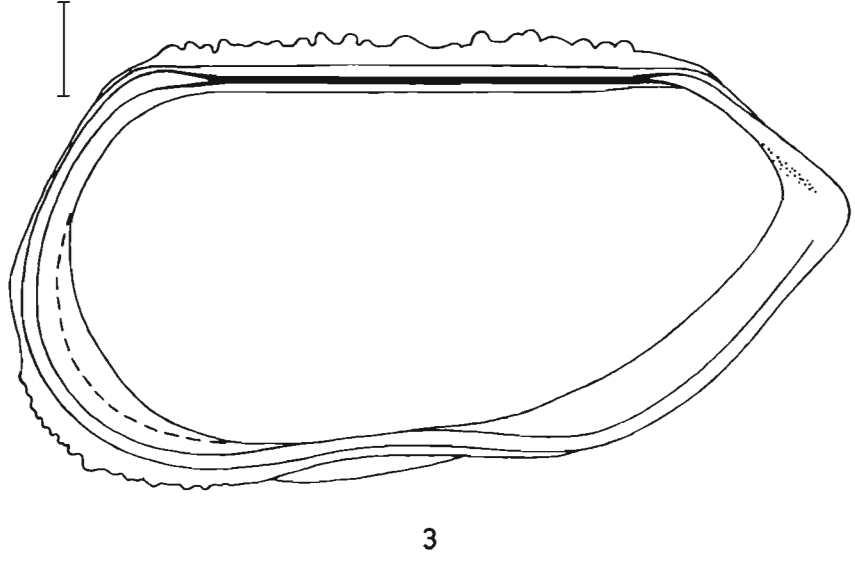
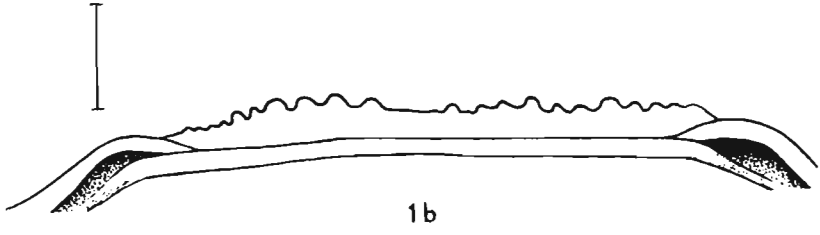
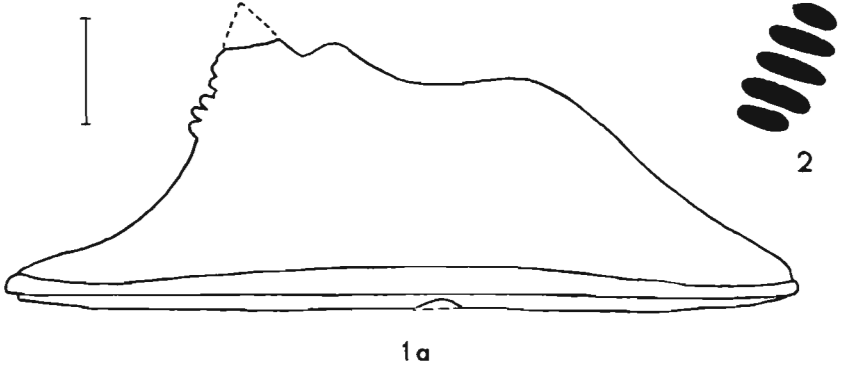


Plate IV

Monoceratina bugensis n.sp.

Fig. 1. Left valve (O.I/49); *a* dorsal view, *b* hinge margin.

Fig. 2. Right valve (O.I/47); muscle scars.

Fig. 3. Right valve (O.I/46); inside view.

Plate V

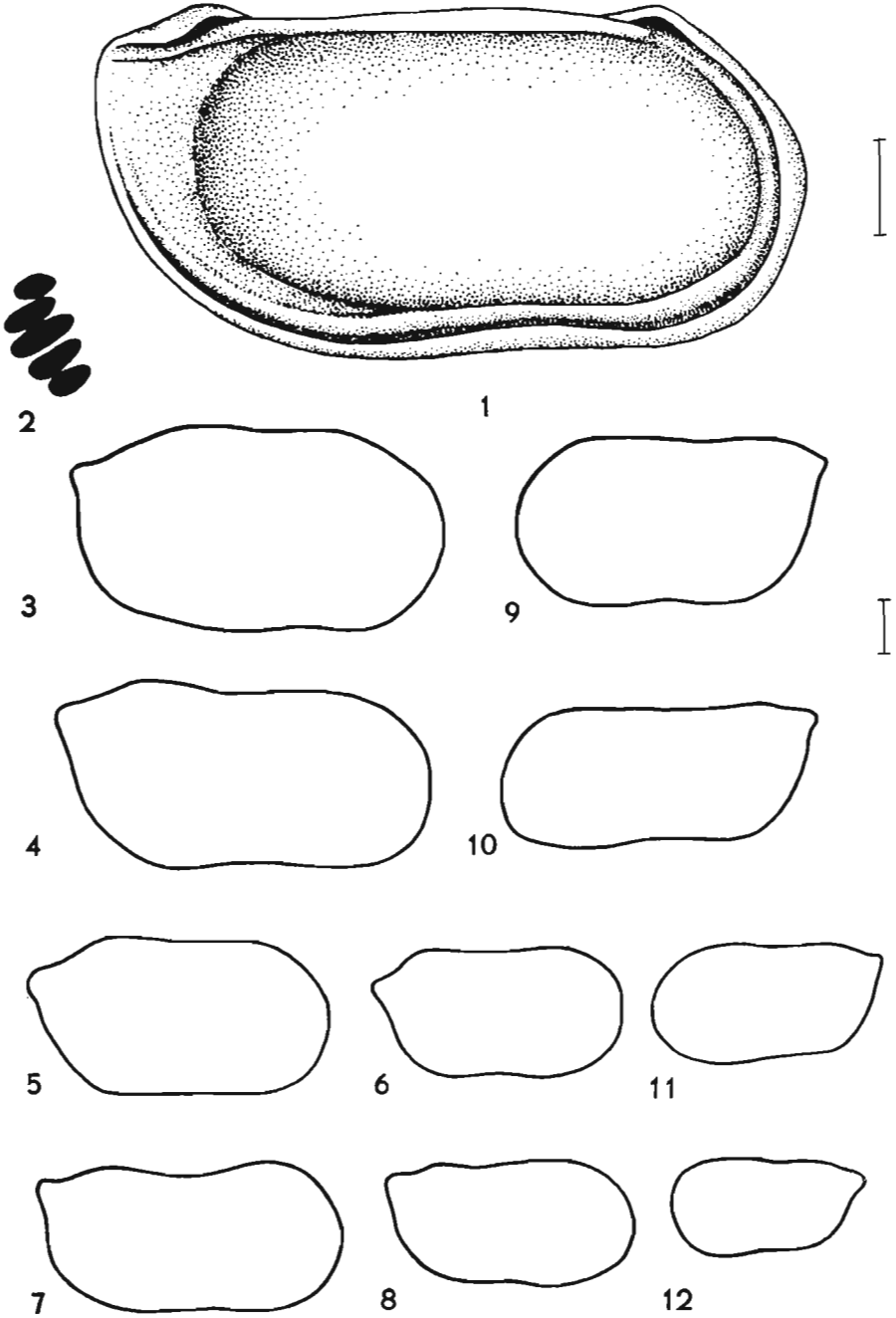
Monoceratina umbonata (Williamson)

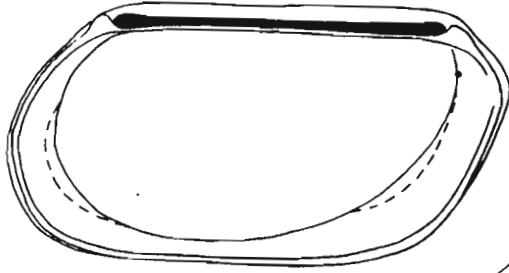
Fig. 1. Left valve (O.I/56); inside view.

Fig. 2. Left valve (O.I/57); muscle scars.

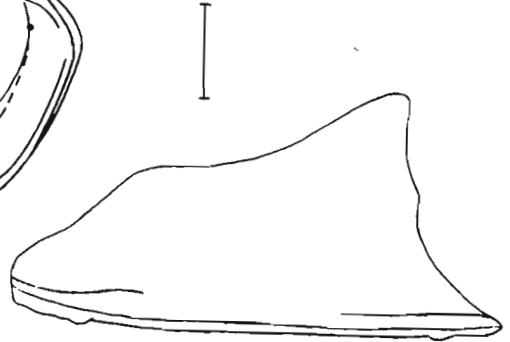
Fig. 3-8. Right valves (O.I/80-85); different instars.

Fig. 9-12. Left valves (O.I/86-89); different instars.

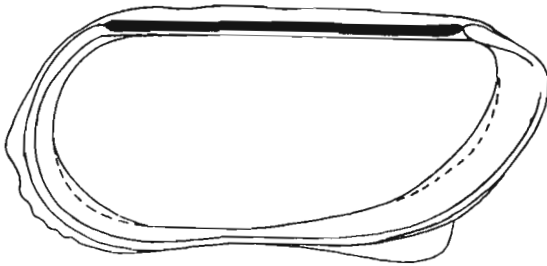




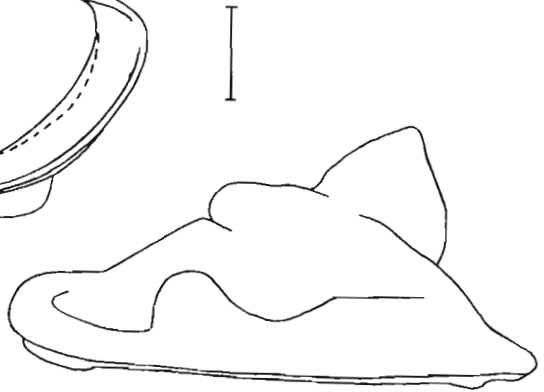
1a



1b



2a



2b



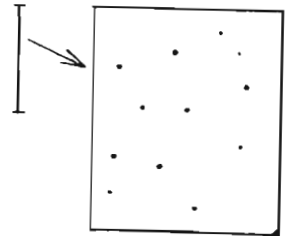
3



4



5



6

Plate VI

Monoceratina acanthoptera (Marsson)

Fig. 1. Right valve (O.I/68); a inside view, b dorsal view.

Monoceratina tuberosa n.sp.

Fig. 2. Right valve (O.I/72); a inside view, b dorsal view

Fig. 3. Left valve (O.I/71); hinge margin.

Monoceratina strangulata (Bosquet)

Fig. 4. Left valve (O.I/40); hinge margin.

Fig. 5. Left valve (O.I/39); dorsal view.

Monoceratina flata n.sp.

Fig. 6. Left valve (O.I/65); distribution of normal pore canals.

Plate VII

Monoceratina flata n.sp.

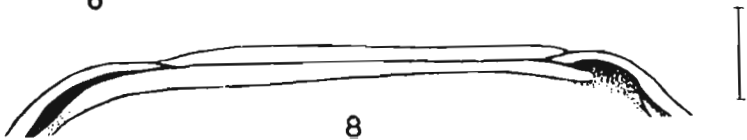
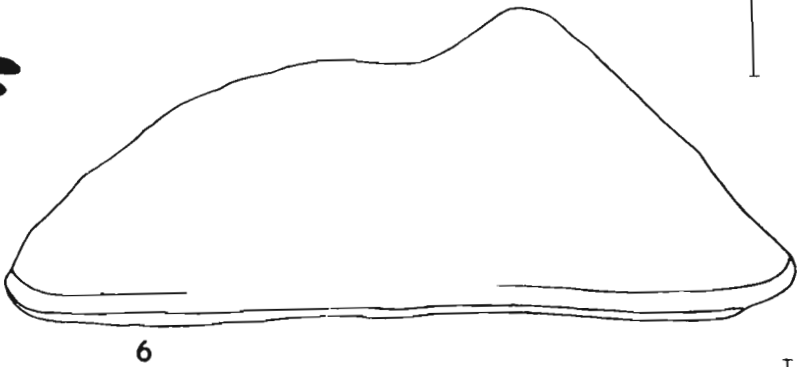
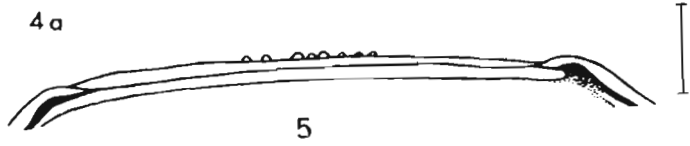
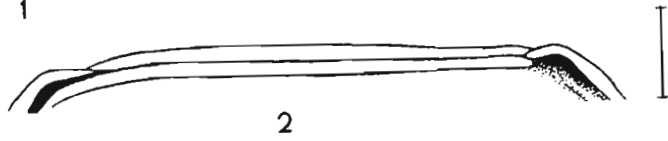
- Fig. 1. Right valve (O.I/63); dorsal view.
- Fig. 2. Left valve (O.I/64); hinge margin.
- Fig. 3. Left valve (O.I/65); muscle scars.

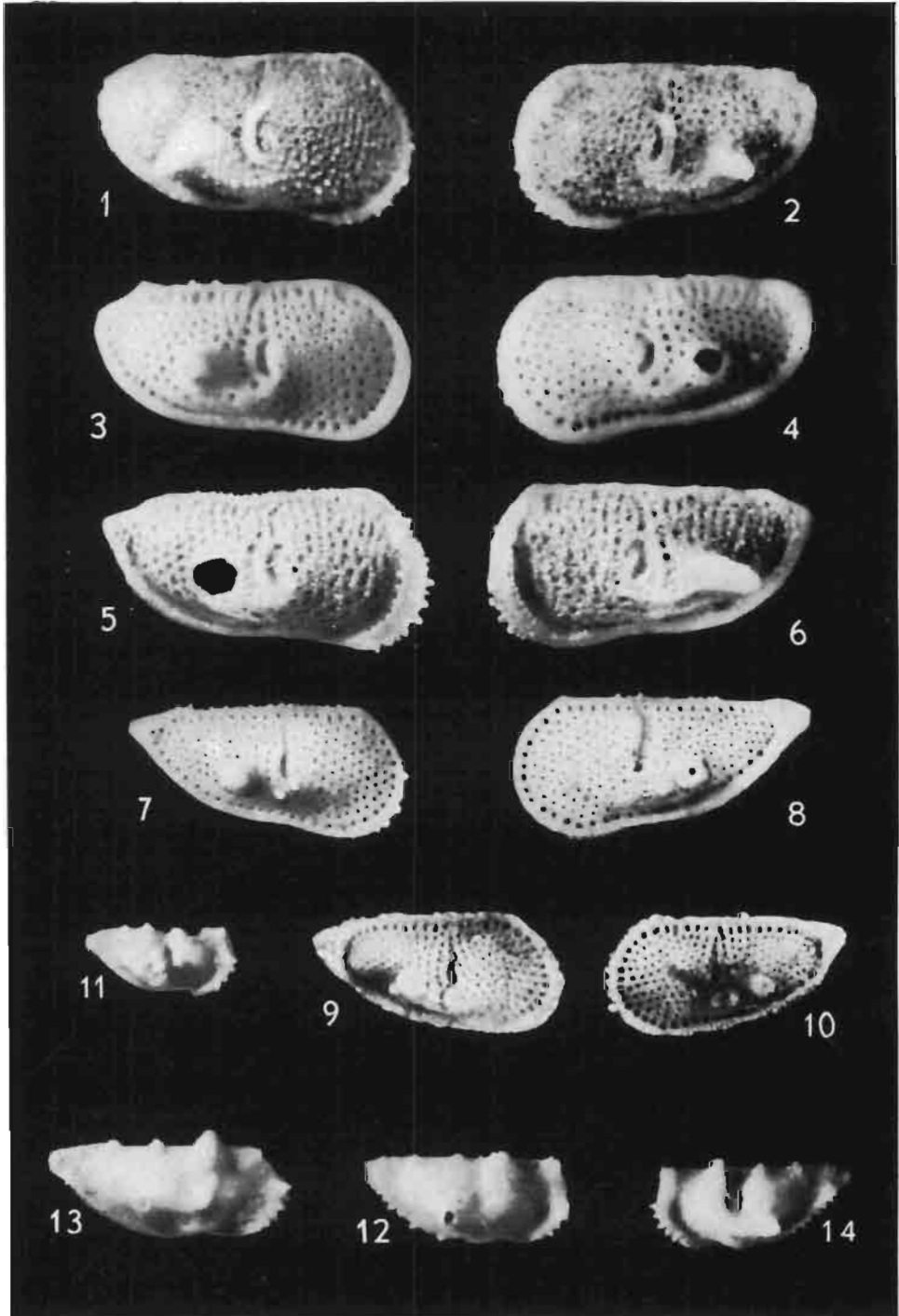
Monoceratina howensis n.sp.

- Fig. 4. Right valve (O.I/73); *a* dorsal view, *b* muscle scars.
- Fig. 5. Left valve (O.I/75); hinge margin.

Monoceratina brevispina n.sp.

- Fig. 6. Right valve (O.I/61); dorsal view.
- Fig. 7. Right valve (O.I/62); muscle scars.
- Fig. 8. Left valve (O.I/60); hinge margin.





Phot. L. Łuszczewska

Plate VIII

Monoceratina pedata (Marsson)

Fig. 1. Mature individual, right valve (O.I/1).

Fig. 2. Mature individual, left valve (O.I/2).

Monoceratina compacta n.sp.

Fig. 3. Holotype, mature individual; right valve (O.I/6).

Fig. 4. Mature individual, left valve (O.I/7).

Monoceratina polonica n.sp.

Fig. 5. Mature individual, right valve (O.I/4).

Fig. 6. Holotype, mature individual; left valve (O.I/5).

Monoceratina mielnicensis n.sp.

Fig. 7. Mature individual, right valve (O.I/11).

Fig. 8. Holotype, mature individual; left valve (O.I/12).

Fig. 9. Mature individual, right valve (O.I/9).

Fig. 10. Mature individual, left valve (O.I/10).

Monoceratina montuosa (Jones)

Fig. 11. Instar V, right valve (O.I/33).

Fig. 12. Instar VI, right valve (O.I/34).

Fig. 13. Instar VII, right valve (O.I/35).

Fig. 14. Instar VI, left valve (O.I/36).

Fig. 1-8, 11-14: Mielnik, 1.1 m. above hard ground, Lower Maastrichtian; $\times 45$.

Fig. 9-10: Bochoznica, 6 m. under hard ground, Upper Maastrichtian; $\times 43$.

Pl. IX

Monoceratina howensis n.sp.

Fig. 1. Mature individual, right valve (O.I/28).

Fig. 2. Holotype, mature individual; left valve (O.I/29).

Monoceratina ?howensis n.sp.

Fig. 3. Mature individual, right valve (O.I/30).

Monoceratina strangulata (Bosquet)

Fig. 4. Mature individual, left valve (O.I/39). Pamiętowo, 257 m., Lower Paleocene;
× 45.

Monoceratina tuberosa n.sp.

Fig. 5. Holotype, mature individual; right valve (O.I/69).

Fig. 6. Mature individual, left valve (O.I/70).

Monoceratina acanthoptera (Marsson)

Fig. 7. Mature individual, right valve (O.I/66).

Fig. 8. Mature individual, left valve (O.I/67).

Monoceratina laevioides similis n.subsp.

Fig. 9. Instar III, right valve (O.I/16).

Fig. 10. Instar IV, right valve (O.I/17).

Fig. 11. Instar V, right valve (O.I/18).

Fig. 12. Instar VI, right valve (O.I/19).

Fig. 13. Holotype, mature individual; right valve (O.I/20).

Monoceratina laevioides laevioides Bonnema

Fig. 14. Instar III, right valve (O.I/22).

Fig. 15. Instar IV, right valve (O.I/23).

Fig. 16. Instar V, right valve (O.I/24).

Fig. 17. Instar VI, right valve (O.I/25).

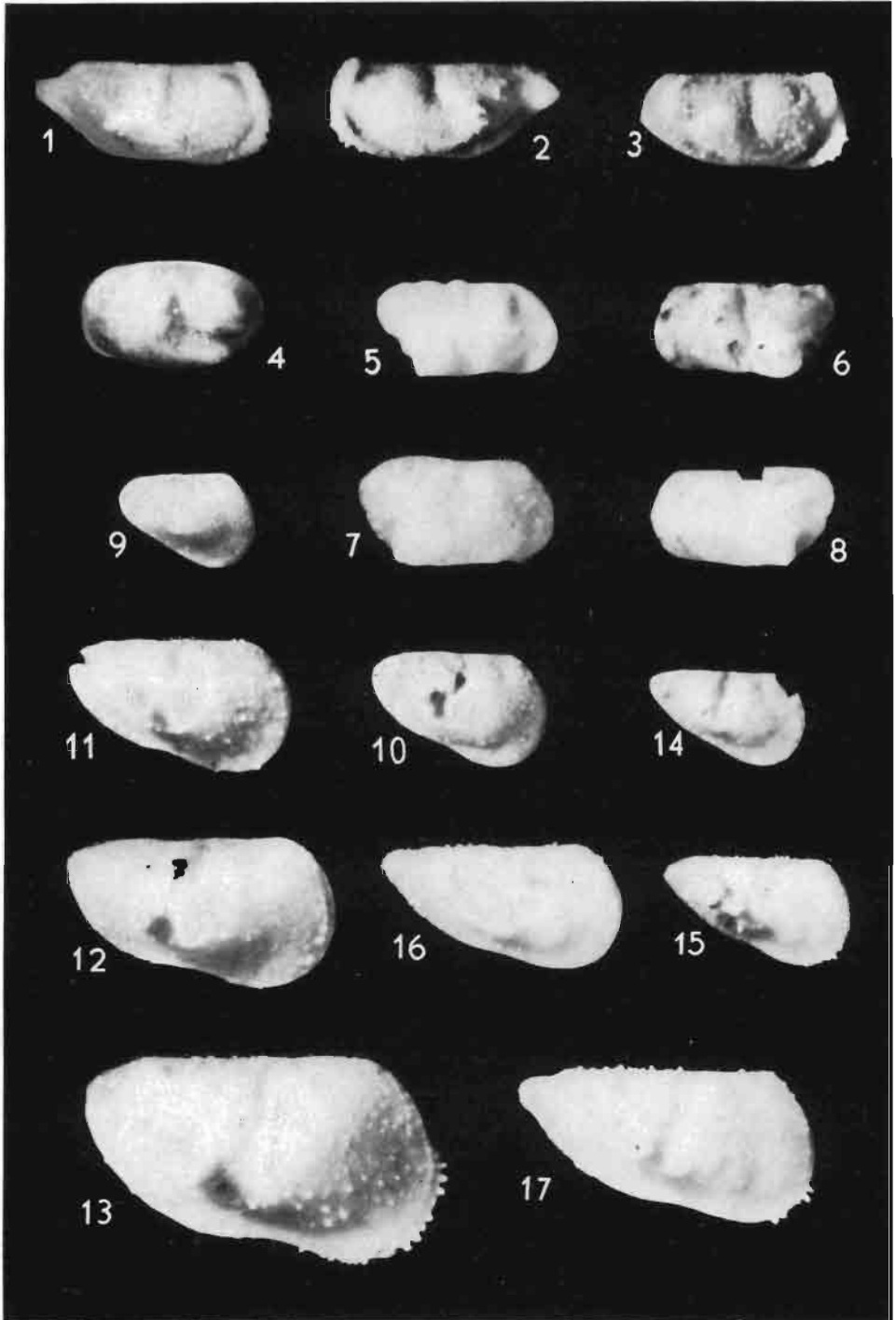
Fig. 1-3.: Mielnik, 1.1 m. above hard ground, Lower Maastrichtian; × 45.

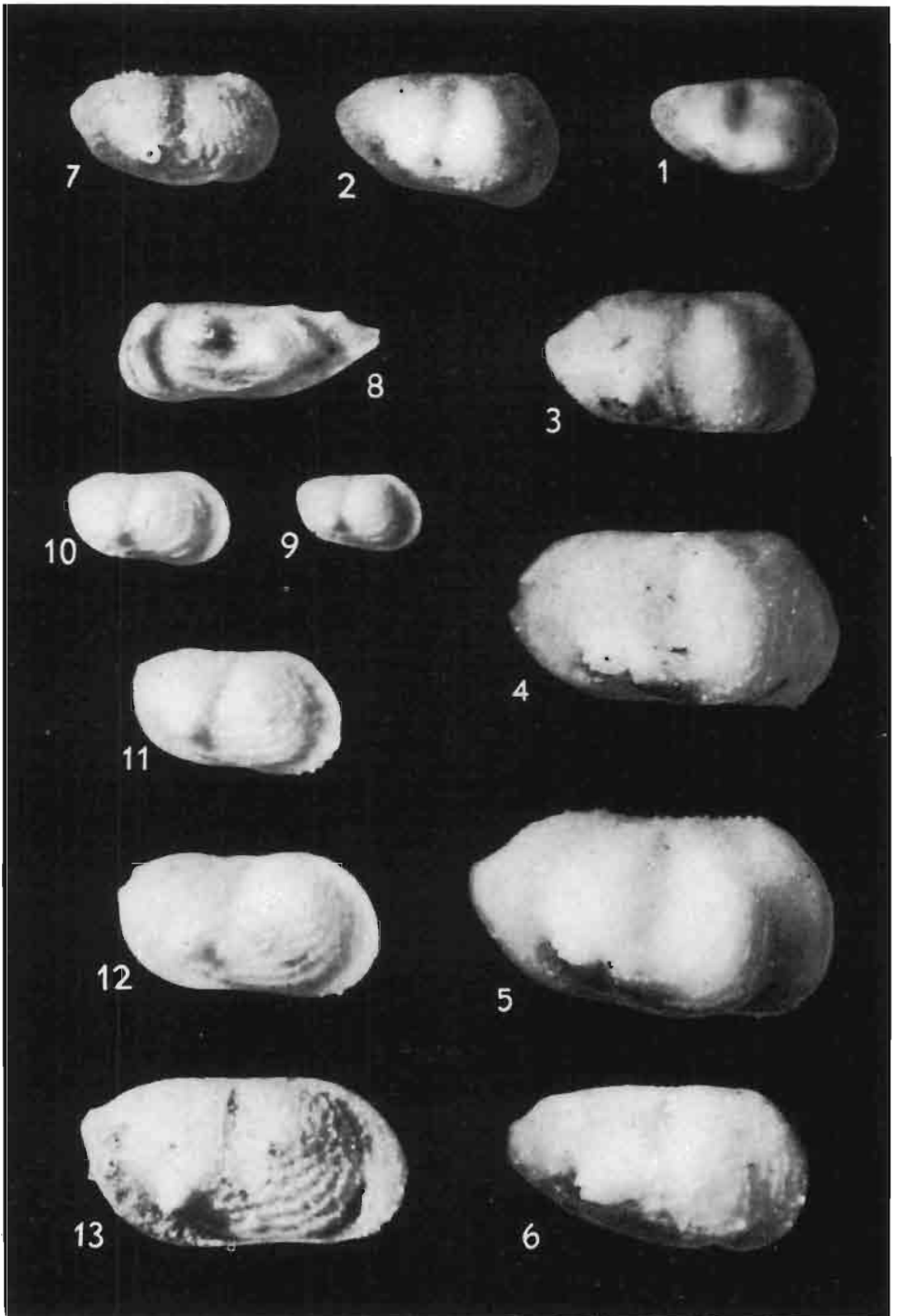
Fig. 5-6. Pamiętowo, 283.4 m., Lower Maastrichtian; × 45.

Fig. 7-8: Pamiętowo, 286.5 m., Lower Maastrichtian; × 45.

Fig. 9-13: Mielnik, 1.1 m. above hard ground, Lower Maastrichtian; × 60.

Fig. 14-17: Mielnik, 1.1 m. under hard ground, Campanian; × 60.





Phot. L. Łuszczewska

Plate X

Monoceratina bugensis n.sp.

- Fig. 1. Instar IV, right valve (O.I/43).
Fig. 2. Instar V, right valve (O.I/44).
Fig. 3. Instar VI, right valve (O.I/77).
Fig. 4. Instar VII, right valve (O.I/45).
Fig. 5. Holotype, mature individual; right valve (O.I/46).
Fig. 6. Mature individual, right valve (O.I/41). Bochtotnica, 6 m. under hard ground, Upper Maastrichtian; $\times 60$.

Monoceratina cf. *umbonata* (Williamson)

- Fig. 7. Mature individual, right valve (O.I/58). Mielnik, 1.1 m. under hard ground, Campanian; $\times 60$.

Monoceratina stiringi Bonnema

- Fig. 8. Mature individual, left valve (O.I/26). Mielnik, 1.1 m. above hard ground, Lower Maastrichtian; $\times 45$.

Monoceratina umbonata (Williamson)

- Fig. 9. Instar III, right valve (O.I/50).
Fig. 10. Instar IV, right valve (O.I/51).
Fig. 11. Instar V, right valve (O.I/52).
Fig. 12. Instar VI, right valve (O.I/53).
Fig. 13. Mature individual, right valve (O.I/54).

Fig. 1-5, 9-13: Mielnik, 1.1 m. above hard ground, Lower Maastrichtian; $\times 60$.

Plate XI

- Fig. 1. *Monoceratina longispina* (Bosquet), mature individual; left valve (O.I/38). Mielnik, 1.1 m. above hard ground, Lower Maastrichtian; $\times 45$.
- Fig. 2. *Monoceratina crassa* n.sp., mature individual; hinge margin of left valve (O.I/79).
- Fig. 3. *Monoceratina umbonata* (Williamson), mature individual; inside view of left valve (O.I/78).
- Fig. 4. *Monoceratina mielnicensis* n.sp., mature individual; inside view of left valve (O.I/76).
- Fig. 5. *Monoceratina flata* n.sp., holotype, mature individual; right valve (O.I/63).
- Fig. 6. *Monoceratina crassa* n.sp., holotype, mature individual, female; right valve (O.I/73).
- Fig. 7. Same species, mature individual, male; left valve (O.I/75).
- Fig. 8. Same species, mature individual, female; left valve (O.I/74).
- Fig. 9. *Monoceratina brevispina* n.sp., holotype, mature individual; left valve (O.I/60).
- Fig. 10. *Monoceratina mielnicensis* n.sp., mature individual; muscle scars of left valve (O.I/182).
- Fig. 11. *Monoceratina flata* n.sp., mature individual; muscle scars of right valve (O.I/181).

Fig. 2-9: Pamiętowo, 283.4 m., Lower Maastrichtian; $\times 43$.

Fig. 10-11: Pamiętowo, 283.4 m., Lower Maastrichtian; $\times 150$.

