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A NEW SPECIES OF THE ACANTHODIAN FISH FROM THE KOSTYUKOVICHI REGIONAL STAGE (MIDDLE DEVONIAN, EIFELIAN) OF BELARUS

A new species of the acanthodian of *Cheiracanthoides pinskensis* sp. nov. has been described on the basis of some isolated scales from the Kostyukovichi deposits of the Eifelian Stage of the Middle Devonian of Belarus. The photographs of the external appearance of the scales and their thin sections are given in the Plates. Additionally, the paper presents the data of the associated organic remains found together with the scales of the new acanthodian representative. A detailed lithological description of the enclosing rocks is also provided. The correlation of the Kostyukovichi deposits of Belarus with the coeval sediments widespread in the adjacent territories is given. The described new species complements the taxonomic composition of the ichthyofauna known from the deposits of the Upper Eifelian of the Middle Devonian of the west of the East European platform.

Key words: Belarus; acanthodians; *Cheiracanthoides pinskensis* sp. nov.; Kostyukovichi Regional Stage; Eifelian; Middle Devonian; scales.

Table 1. Fig. 23. Ref.: 35 titles.

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НОВЫЙ ВИД АКАНТОДОВОЙ РЫБЫ ИЗ КОСТЮКОВИЧСКОГО ГОРИЗОНТА (СРЕДНИЙ ДЕВОН, ЭЙФЕЛЬ) БЕЛАРУСИ

Из отложений костюковичского горизонта эйфельского яруса среднего девона Беларуси описан новый вид акантода *Cheiracanthoides pinskensis* sp. nov. на основе изолированных чешуй. Фотографии внешнего вида чешуй и их шлифов приводятся в фототаблицах. Отдельно в статье указываются данные по сопутствующим органическим остаткам, обнаруженным совместно с чешуями этого нового представителя акантодов. Дополнительно дается подробная литологическая характеристика вмещающих пород. Приводится корреляция костюковичских отложений Беларуси с одновозрастными образованиями, широко развитыми на сопредельных территориях. Описанный новый вид дополняет таксономический состав ихтиофауны, известной из отложений верхнего эйфеля среднего девона запада Восточно-Европейского платформы.

Ключевые слова: Беларусь; акантоды; *Cheiracanthoides pinskensis* sp. nov.; костюковичский горизонт; эйфельский ярус; средний девон; чешуи.

Табл. 1. Рис. 23. Библиогр.: 35 назв.

Introduction. In the Devonian deposits of Belarus the acanthodian skeletal elements are usually represented by isolated scales and fin spines. V. N. Karatajūtė-Talimaa and L. A. Lyarskaya were the first researchers who initiated their study within the country territory. In the early seventies of the past century they determined for the first time the acanthodian remains in the Lower and Middle Devonian deposits and made their identifications [1—3]. However, the most detailed study of the diversity of the Early and Middle Devonian acanthodians of Belarus and an analysis of their assemblages for the stratigraphic purposes had been carried out by J. J. Valiukevičius from the beginning of the eighties of the 20th century till 2000 [4—12]. As a result of these studies a zonal subdivision of the Lower and Middle Devonian deposits of Belarus

was developed on the basis of the acanthodians [11; 12]. In 2002 the author of this paper began the study of various Devonian ichthyofauna representatives including the acanthodians. The study of the Middle Devonian acanthodians in the territory of Belarus by the earlier researchers over a rather long period of time does not exclude the discovery of their new taxa. The repeated study of some acanthodian scales from the Kostyukovichi deposits of Belarus has demonstrated that the scales previously defined by the author as *Cheiracanthoides* sp. [13] refer to a new species.

It is also worth noting that the genus *Cheiracanthoides* known only from scales and it is characterized by a rather wide distribution throughout the world. The separate scales of this genus are found in the deposits of the Upper Silurian, Lower and Middle Devonian in the territory of the Baltic States, Belarus, Russia, Ukraine, Poland, Germany, Spitsbergen, Canada, USA, China, Australia and some other countries. The description of a new species of this genus of acanthodians is presented below.

Geological setting and stratigraphy. The deposits of the Kostyukovichi Regional Stage are rather widespread in the territory of Belarus [14; 15]. These are exposed in numerous boreholes within the southern part of the Baltic Syneclise, in the territory of the Orsha Depression, within the Latvian, Zhlobin and Bragin—Loyev Saddles, within the limits of the Vileyka and Bobruysk Buried Ridges of the Belarusian Anteclise, in the territory of the northwestern slope of the Voronezh Anteclise and within the Pripyat Trough. According to the latest Stratigraphic Chart of the Devonian deposits of Belarus (2010) [15] and the paper by T. G. Obukhovskaya with co-authors [16], dedicated to the substage division of the deposits of the Eifelian Stage of the Middle Devonian of Belarus, the deposits of Kostyukovichi Regional Stage belong to the Upper Substage of the Eifelian Stage of the Middle Devonian.

These deposits correspond in their miospores composition to the Rhabdosporites langii — Chelinospora timanica zone [15], in the acanthodians — to the Nostolepis kernavensis zone [5; 11; 12; 17; 18], and in the conodonts — to the Polygnathus xylus ensensis zone [19] (Table 1). Within the territory of the Volyn-Podolia region an age analogue of the Kostyukovichi Regional Stage are the sediments of the Veliky Most Subformation of the lower part of the Lopushany Formation of the Eifelian Stage [20—22], in the territory of the central Russia — the deposits of the Chernyi Yar Regional Stage of the Eifelian Stage [12; 23], and in the territory of the Baltic States — the sediments of the Kernavė Regional Substage of the Narva Regional Stage of the Eifelian Stage [5; 24; 25].

T a b l e 1. — The Upper Eifelian deposits of Belarus and their correlation with the synchronous deposits in the adjacent territories (according to [15; 16], with minor clarifications)

T a б л и ц a 1. — Верхнеэйфельские отложения Беларуси и их корреляция с одновозрастными образованиями на сопредельных территориях (согласно [15; 16], с небольшими уточнениями)

System	Series	Stage	Substage	Standard Conodont Zone	Belarus		Regional zones		Main Devonian Field (Baltic)	Central Devonian Field (Russia)	Volyn-Podolia region (Ukraine)
					Regional Superstage	Regional Stage	Miospores	Acanthodians	Regional Substage	Regional Stage	Subformation
Devonian	Middle	Eifelian	Upper	Polygnathus xylus ensensis	Narva	Kostyukovichi	Rhabdosporites langii – Chelinospora timanica	Nostolepis kernavensis	Kernavé	Chernyi Yar	Veliky Most

So, fifteen scales of a new acanthodian species were found in the Pinsk 26 borehole (Figure 1) drilled within the northwesternmost part of the Turov Centrocline of the Pripyat Trough in the depth range of 420.1—422.4 m in the grey, greenish-grey, creamy-grey, dirty-grey, unclearly layered, strong, massive, platy, fine-grained, in places, cryptocrystalline, finely porous and slightly fissured clayey dolomites belonging to the deposits of the Kostyukovichi Regional Stage. Some worm tubules of *Spirorbis* sp., scolecodonts, isolated corals, numerous shell fragments of the articulate and inarticulate brachiopods, some shell fragments of the bivalves, crinoid segments, numerous conodonts of *Polygnathus* sp., *P. linguiformis klapperi* Clausen, Leuteritz et Ziegler, 1979, *P. linguiformis linguiformis* Hinde, 1879, *Tortodus* sp., *Icriodus* sp., *I. stephensoni* Sparling, 1983, *I. orri* Barrick et Klapper, 1983, *I. struvei* Weddige, 1977, *Belodella* sp., *Neopanderodus* sp., as well as the ichthyofauna remains represented by small fragments of an articular process of Antiarcha gen. indet., a spinal plate of *Actinolepis* sp., the scales of *Cheiracanthoides proprius* Valiukevičius, 1985, *Cheiracanthus* sp., *C. brevicostatus* Gross, 1973, *Markacanthus costulatus*

Figure 1. — Map of the location of the borehole sections where the scales of a new representative of the acanthodian fish were found. Boreholes: 1 — Pinsk 26; 2 — Pinsk 10; 3 — Zhitkovichi 2; 4 — Bykhov 1

Рисунок 1. — Карта расположения разрезов скважин, в которых были найдены чешуи нового представителя акантодов. Скважины: 1 — Пинск 26; 2 — Пинск 10; 3 — Житковичи 2; 4 — Быхов 1

Valiukevičius, 1985, *Ptychodictyon* sp., "*Acanthoides*" sp., *Karksilepis* sp., Chondrichthyes indet., Osteolepididae gen. indet., *Orvikuina* sp., *O. vardiaensis* Gross, 1953, "*Moythomasia*" sp., Actinopterygii indet., teeth of Sarcopterygii indet., Actinopterygii indet. and indefinable skeletal elements of Osteichthyes indet. were also found in these clayey dolomites [13; 26]. In the Pinsk 10 borehole (Figure 1) confined to the southwestern part of the Starobin Centrocline of the Pripyat Trough more than fifteen scales of the new taxon described below were found in the depth range of 241.6—245.2 m in grey, light grey, pelitomorphic, platy, strong, massive, in places, with rare solution cavities, unclearly layered clayey dolomites belonging to the deposits of the Kostyukovichi Regional Stage. Along with them some rare fragments of the lingulid shells, rare scolecodonts, tubules of the worms of *Spirorbis* sp., some segments of the crinoids, conodonts and vertebrates represented by the dentine tubercles of *Ganosteus* sp., a tritor of Ptyctodontida gen. indet., the scales of *Cheiracanthus* sp., *C. brevicostatus* Gross, 1973 *Cheiracanthoides proprius* Valiukevičius, 1985, "*Acanthoides*" sp., Osteolepididae gen. indet., *Orvikuina* sp., *O. vardiaensis* Gross, 1953, Actinopterygii indet., the teeth of *Onychodus* sp., Sarcopterygii indet. and Actinopterygii indet. were also found in these clayey dolomites [13; 26]. Five scales of a new representative of the acanthodians were found in the Zhitkovichi 2 borehole (Figure 1) drilled in the southwestern part of the Starobin Centrocline of the Pripyat Trough in the depth range of 190.5—191.0 m in the light grey, platy, strong, massive, unclearly layered clayey dolomites belonging to the deposits of the Kostyukovichi Regional Stage. Together with them small plate fragments of *Schizosteus striatus* (Gross, 1933), the scales of *Cheiracanthus longicostatus* Gross, 1973, *Orvikuina vardiaensis* Gross, 1953 and Actinopterygii indet. were also found in these clayey dolomites [13; 27]. And finally, two scales of a new species of acanthodians were discovered in the Bykhov 1 borehole (Figure 1) drilled in the Orsha Depression and Zhlobin Saddle junction zone in the depth range 201.4—202.4 m in the light grey, dense, unclearly layered, platy, clayey limestones also belonging to the deposits of the Kostyukovichi Regional Stage. Along with them numerous small fragments of the inarticulate brachiopod shells, rare segments of the crinoids, some single scolecodonts, one fragment of a fin spine of *Haplacanthus* cf. *marginalis* Agassiz, 1845, a few isolated scales of "*Acanthoides*" sp., *Nostolepis kernavensis* Valiukevičius, 1985, one tooth of Chondrichthyes indet., rare teeth of Onychodontidae gen. indet., some small isolated plate fragments of Placodermi indet., some scale fragments of Actinopterygii indet., *Orvikuina* sp., one indefinable bone fragment of Pisces indet., as well as the conodonts of *Icriodus stephensoni* Sparling, 1983, *Polygnathus linguiformis klapperi* Clausen, Leuteritz et Ziegler, 1979, *P. linguiformis* Hinde, 1879 and *P. webbi* Stauffer, 1938 were revealed in this interval [28].

Materials and methods. The standard rock dissolution technique with formic 5 % and acetic 9 % acids was used to recover scales from the rocks. After rock dissolving the sediment was repeatedly washed with water from the clayey particles and then dried. The dried sediment was viewed using a stereoscopic binocular microscope MBS-1. The acanthodian scales were picked manually and the selected scales were morphologically and histologically studied. The electron microphotographs of the scales were made with a microscope JSM-5610 LV (JEOL, Japan). The photographs of thin sections were taken with Axioskop 40 A Pol and B-1000POL-1 microscopes using anise oil as an immersion liquid. The photographs were processed with Adobe Photoshop CS6, the figures were created with CorelDRAW X3. The Stratigraphic Chart of the Devonian deposits of Belarus (2010) was used as the stratigraphic basis. The described specimens are stored in the Belarusian National Technical University (BNTU), Department of Mining (the collection number BNTU 2).

Results and discussion

Class ACANTHODII Owen, 1846
Order Climatiiformes Berg, 1940
Family indeterminate
Genus *Cheiracanthoides* Wells, 1944

Diagnosis. See in papers by R. Denison [29] and J. Valiukevičius [5].
Type species. *Cheiracanthoides comptus* Wells, 1944 [30].
Remarks. The phylogenetic studies that have been recently carried out cast doubt on the assignment of the genus *Cheiracanthoides* to the Climatiidae family and the Climatiiformes order. Thereby, partially considering these views of the classification in this paper the genus *Cheiracanthoides* is conventionally assigned only to the Climatiiformes order based on the characteristic external morphology of scales and the histological structure of the "*Nostolepis*" type. The additional skeletal materials are needed to substantiate the assignment of this genus to the concrete family.

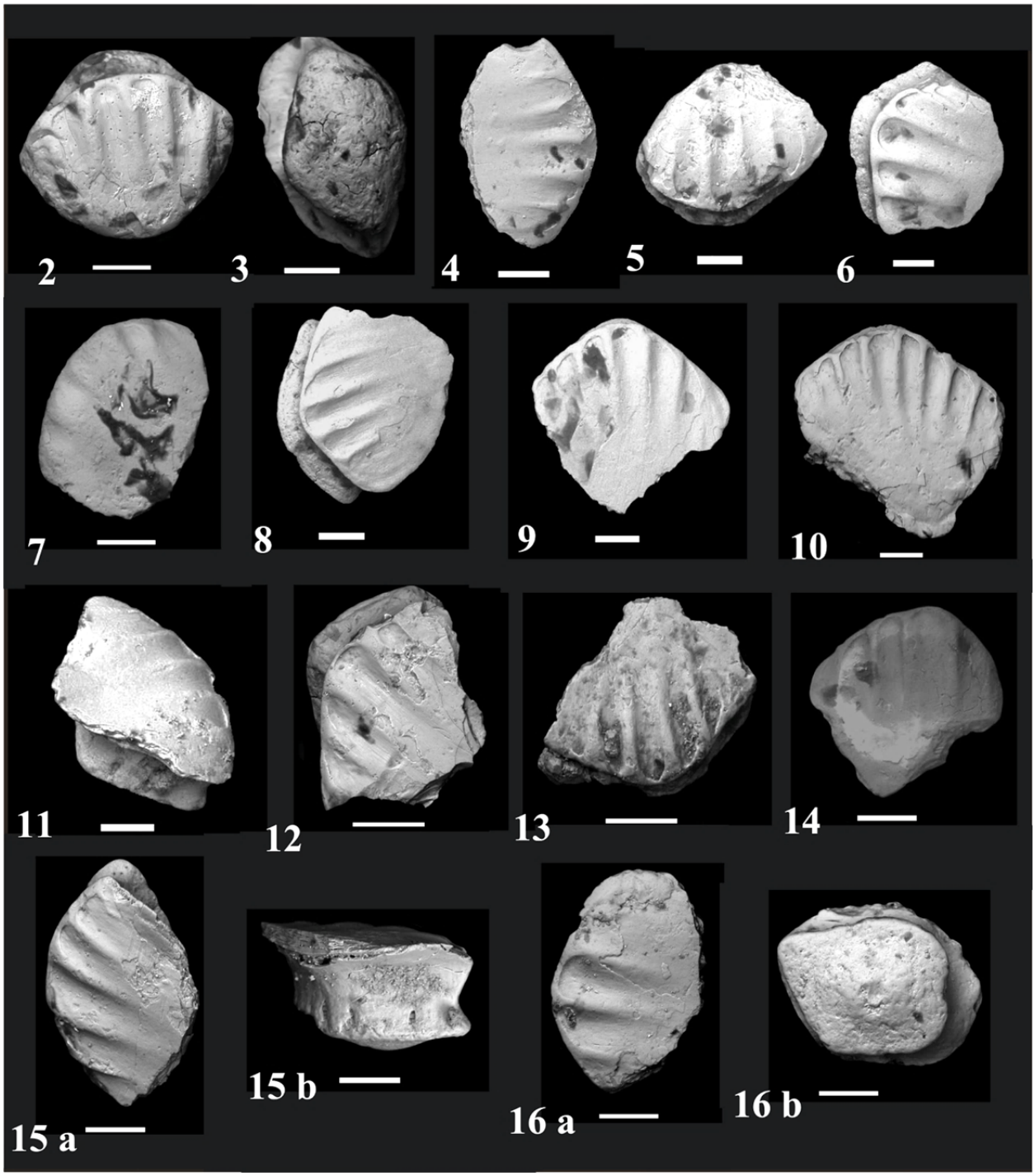
Cheiracanthoides pinskensis **sp. nov.**
Figures 2—23

Type material. *Holotype*. Specimen № 85/7a-4d, scale (Figure 9). Pinsk 10 borehole, depth 245.2 m; northern outskirts of the village of Kormuzh, Luninets district, Brest region, Belarus; Middle Devonian, Eifelian Stage, Upper Substage, Narva Regional Superstage, Kostyukovichi Regional Stage (BNTU. Department of Mining).

Paratypes. 38 scales. Pinsk 10 borehole, depth 245.2 m; northern outskirts of the village of Kormuzh, Luninets district, Brest region, Belarus; Pinsk 26 borehole, depth range of 420.1—422.4 m; near the town of Luninets, Luninets district, Brest region, Belarus; Zhitkovichi 2 borehole, depth 191.0 m; north of the village of Gotsk, Soligorsk district, Minsk region, Belarus; Bykhov 1 borehole, depth range 201.4—202.4 m; near the village of Bolshaya Zimnitsa, Slavgorod district, Mogilev region, Belarus; Middle Devonian, Eifelian Stage, Upper Substage, Narva Regional Superstage, Kostyukovichi Regional Stage. Borehole № 6629, depth 180.5 m; southwestern outskirts of the village of Novostav, Volyn region, Ukraine; Middle Devonian, Eifelian Stage, Veliky Most Subformation (BNTU. Department of Mining).

Remarks. In earlier works of the author [13, p. 26, Text-Figure 2; p. 27, Text-Figure 3; p. 35, Plate III, Figures 4, 5, 9, 10—13] and [26, Text-Figure 2; p. 38] the single scales described here as belonging to a new species were originally identified as *Cheiracanthoides* sp. because of their small number. The scales previously defined as *Cheiracanthoides proprius* Valiukevičius ([22], p. 17, Plate II, Figure 3) in the territory of Volyn region (Ukraine) in the borehole № 6629 belong to a new species.

Diagnosis. Scales up to 0.5 mm long. The crown is rhomboid, rounded-rhomboid, ovate-oblong or oval. The ridges and grooves on the crown are located fan-shaped round and clearly expressed in its anterior part, usually gradually fade out towards the central part and completely disappear in the posterior part. Along the front margin of the crown the grooves form something like a narrow border. The neck is relatively thick and of medium height. The anterolateral walls of the neck in some scales may be penetrated by few pores slightly below the midline. The base is moderately or slightly convex, rounded-rhomboid, elongated oval, elliptical, with a weakly expressed apex usually shifted forward. The crown shows up to six growth lamellae. The anterior part of the crown is composed of simple mesodentine, is penetrated with some narrow branching dentine tubules with lacunae. The posterior part of the crown is composed of the mesodentine tissue with large oriented lacunae covering the entire body of the growth lamellae. The radial, circular and ascending vascular canals are large and distinct. The neck and base are described by a moderate amount of the osteocytes.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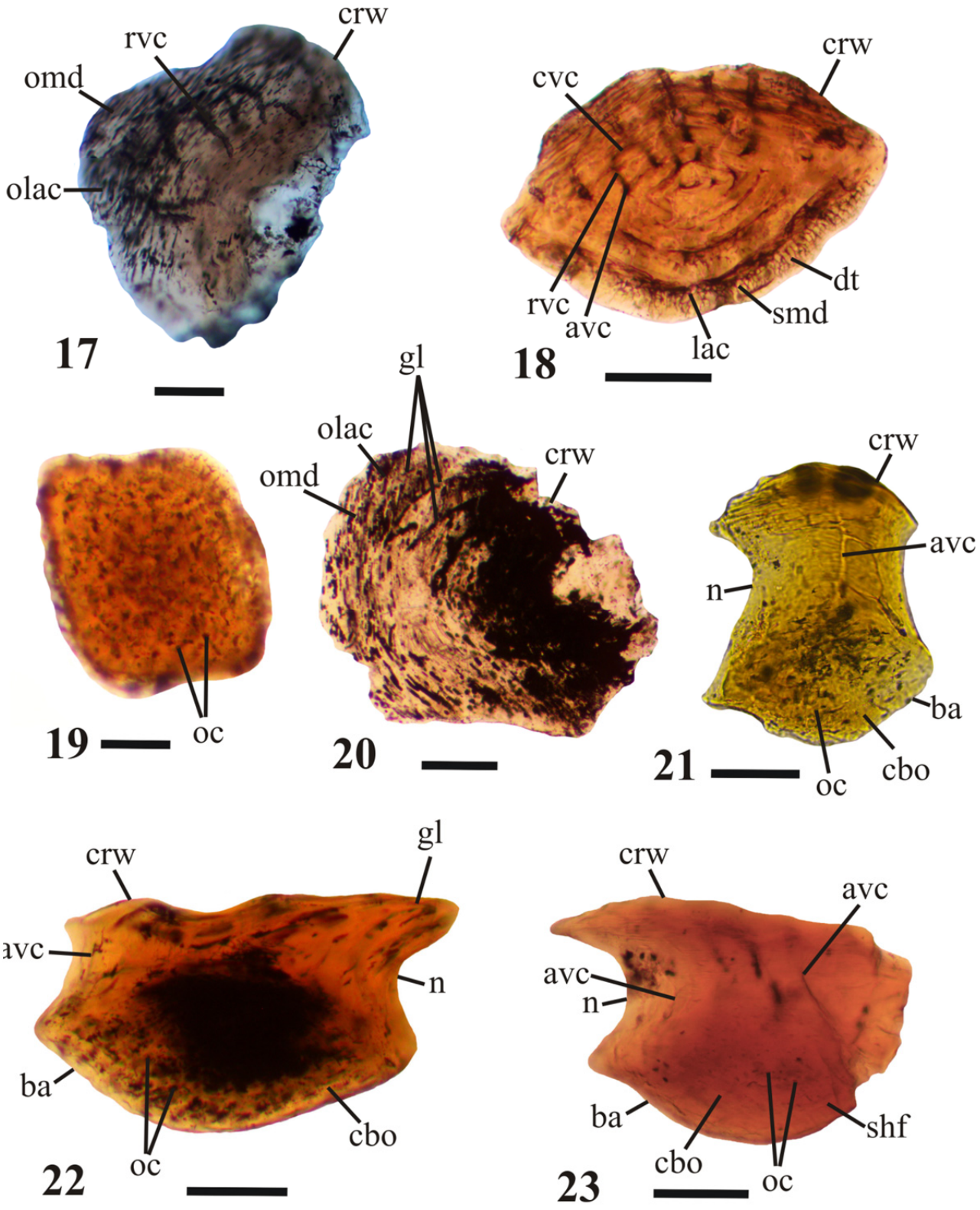
Figures 2—16. — Scales of *Cheiracanthoides pinskensis* sp. nov. All the found scales come from the Upper Eifelian deposits of the Middle Devonian. **2** — Specimen № 57/6-1, scale in oblique crown view, × 200, Zhitkovichi 2 borehole, depth 191.0 m, Kostyukovichi Regional Stage; **3** — Specimen № 57/6-1a, scale in basal view, × 200, Zhitkovichi 2 borehole, depth 191.0 m, Kostyukovichi Regional Stage; **4** — Specimen № 41/2б-1d, scale in crown view, × 180, Pinsk 26 borehole, depth 422.4 m, Kostyukovichi Regional Stage; **5** — Specimen № 41/6б-1a, scale in anterior crown view, × 150, Pinsk 26 borehole, depth 415.7 m, Kostyukovichi Regional Stage; **6** — Specimen № 85/7a-4b, scale in oblique crown view, × 150, Pinsk 10 borehole, depth 245.2 m, Kostyukovichi Regional Stage; **7** — Specimen № 57/6-2, scale in crown view, × 200, crown slightly abraded; Zhitkovichi 2 borehole, depth 191.0 m, Kostyukovichi Regional Stage; **8** — Specimen № 85/7a-4a, scale in oblique crown view, × 160, Pinsk 10 borehole, depth 245.2 m, Kostyukovichi Regional Stage; **9** — Specimen № 85/7a-4d (holotype), scale in crown view, × 150, Pinsk 10 borehole, depth 245.2 m, Kostyukovichi Regional Stage; **10** — Specimen № 41/6б-1q, scale in crown view, × 150, Pinsk 26 borehole, depth 415.7 m, Kostyukovichi Regional Stage; **11** — Specimen № 41/2б-1b, scale in posterior crown view, × 150, Pinsk 26 borehole, depth 422.4 m, Kostyukovichi Regional Stage; **12** — Specimen № 116/16-15, scale in oblique crown view, × 250, Bykhov 1 borehole, depth 201.4 — 202.4 m, Kostyukovichi Regional Stage; **13** — Specimen № 41/6б-1w, scale in anterior crown view, × 250, Pinsk 26 borehole, depth 415.7 m, Kostyukovichi Regional Stage; **14** — Specimen № 41/4a-1f, scale in crown view, × 200, Pinsk 26 borehole, depth 421.2 m, Kostyukovichi Regional Stage; **15** — Specimen № 85/7a-4s: a — scale in oblique crown view, × 180, b — scale in lateral view, × 200, Pinsk 10 borehole, depth 245.2 m, Kostyukovichi Regional Stage; **16** — Specimen № 85/7a-4w: a — scale in crown view, × 200, b — scale in basal view, × 200, Pinsk 10 borehole, depth 245.2 m, Kostyukovichi Regional Stage. All scale bars are 100 μm

Рисунки 2—16. — Чешуи *Cheiracanthoides pinskensis* sp. nov. Все найденные чешуи происходят из верхнеэйфельских отложений среднего девона. **2** — Экземпляр № 57/6-1, чешуя, вид с наклоном сверху, × 200, скважина Житковичи 2, глубина 191,0 м, костюковичский горизонт; **3** — Экземпляр № 57/6-1a, чешуя, вид снизу, × 200, скважина Житковичи 2, глубина 191,0 м, костюковичский горизонт; **4** — Экземпляр № 41/2б-1d, чешуя, вид сверху, × 180, скважина Пинск 26, глубина 422,4 м, костюковичский горизонт; **5** — Экземпляр № 41/6б-1a, чешуя, вид спереди сверху, × 150, скважина Пинск 26, глубина 415,7 м, костюковичский горизонт; **6** — Экземпляр № 85/7a-4b, чешуя, вид с наклоном сверху, × 150, скважина Пинск 10, глубина 245,2 м, костюковичский горизонт; **7** — Экземпляр № 57/6-2, чешуя, вид сверху, × 200, крона слегка истерта, скважина Житковичи 2, глубина 191,0 м, костюковичский горизонт; **8** — Экземпляр № 85/7a-4a, чешуя, вид с наклоном сверху, × 160, скважина Пинск 10, глубина 245,2 м, костюковичский горизонт; **9** — Экземпляр № 85/7a-4d (голотип), чешуя, вид сверху, × 150, скважина Пинск 10, глубина 245,2 м, костюковичский горизонт; **10** — Экземпляр № 41/6б-1q, чешуя, вид сверху, × 150, скважина Пинск 26, глубина 415,7 м, костюковичский горизонт; **11** — Экземпляр № 41/2б-1b, чешуя, вид сзади сверху, × 150, скважина Пинск 26, глубина 422,4 м, костюковичский горизонт; **12** — Экземпляр № 116/16-15, чешуя, вид с наклоном сверху, × 250, скважина Быхов 1, глубина 201,4 — 202,4 м, костюковичский горизонт; **13** — Экземпляр № 41/6б-1w, чешуя, вид спереди сверху, × 250, скважина Пинск 26, глубина 415,7 м, костюковичский горизонт; **14** — Экземпляр № 41/4a-1f, чешуя, вид сверху, × 200, скважина Пинск 26, глубина 421,2 м, костюковичский горизонт; **15** — Экземпляр № 85/7a-4s, чешуя: a — вид с наклоном сверху, × 180, b — вид сбоку, × 200, скважина Пинск 10, глубина 245,2 м, костюковичский горизонт; **16** — Экземпляр № 85/7a-4w, чешуя: a — вид сверху, × 200, b — вид снизу, × 200, скважина Пинск 10, глубина 245,2 м, костюковичский горизонт. Длина всех масштабных линеек 100 μm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Figures 17—23. — Microstructure of the scales of *Cheiracanthoides pinskensis* sp. nov. 17 — horizontal section of the scale crown. Specimen № 85/7a-4z, Pinsk 10 borehole, depth 245.2 m, Kostyukovichi Regional Stage; **18** — horizontal section of the scale crown. Specimen № 57/6-1a, Zhitkovichi 2 borehole, depth 191.0 m, Kostyukovichi Regional Stage; **19** — scale horizontal section at the neck level. Specimen № 85/7a-4m, Pinsk 10 borehole, depth 245.2 m, Kostyukovichi Regional Stage; **20** — horizontal section of the scale crown. Specimen № 41/6б-1n, Pinsk 26 borehole, depth 415.7 m, Kostyukovichi Regional Stage; **21** — scale vertical longitudinal section. Specimen № 85/7a-4n, Pinsk 10 borehole, depth 245.2 m, Kostyukovichi Regional Stage; **22** — scale vertical longitudinal section. Specimen № 85/7a-4p, Pinsk 10 borehole, depth 245.2 m, Kostyukovichi Regional Stage; **23** — scale vertical section. Specimen № 85/7a-4k, Pinsk 10 borehole, depth 245.2 m, Kostyukovichi Regional Stage. All scale bars are 100 μm.
Abbreviations: avc — ascending vascular canal, ba — base, cbo — cellular bone, cc — circular vascular canal, crw — crown, dt — dentine tubule, gl — growth lamella, lac — lacuna, n — neck, oc — osteocyte cavity, omd — oriented mesodentine, olac — oriented lacuna, rvc — radial vascular canal; shf — Sharpey's fibres, smd — simple mesodentine

Рисунки 17—23. — Микроструктура чешуй *Cheiracanthoides pinskensis* sp. nov. 17 — горизонтальный срез чешуи через крону. Экземпляр № 85/7a-4z, скважина Пинск 10, глубина 245,2 м; костюковичский горизонт; **18** — горизонтальный срез чешуи через крону. Экземпляр № 57/6-1a, скважина Житковичи 2, глубина 191,0 м; костюковичский горизонт; **19** — горизонтальный срез чешуи на уровне шейки. Экземпляр № 85/7a-4m, скважина Пинск 10, глубина 245,2 м; костюковичский горизонт; **20** — горизонтальный срез чешуи через крону. Экземпляр № 41/6б-1n, скважина Пинск 26, глубина 415,7 м; костюковичский горизонт; **21** — вертикальный продольный срез чешуи. Экземпляр № 85/7a-4n, скважина Пинск 10, глубина 245,2 м; костюковичский горизонт; **22** — вертикальный продольный срез чешуи. Экземпляр № 85/7a-4p, скважина Пинск 10, глубина 245,2 м; костюковичский горизонт; **23** — вертикальный срез чешуи. Экземпляр № 85/7a-4k, скважина Пинск 10, глубина 245,2 м; костюковичский горизонт. Длина всех масштабных линеек 100 μm.
Буквенные обозначения: avc — восходящий сосудистый канал, ba — основание, cbo — клеточная костная ткань, cc — циркулярный сосудистый канал, crw — крона, dt — дентиновый каналец, gl — пластина нарастания, lac — лакуна, n — шейка, oc — полость остеоцита, omd — ориентированный мезодентин, olac — ориентированная лакуна, rvc — радиальный сосудистый канал; shf — Шарпеевые волокна, smd — простой мезодентин

Description. *Morphology.* Small scales are 0.25 to 0.5 mm long. The scales 0.3 to 0.4 mm in length usually dominate. The crown of the scales is rhomboid, rounded-rhomboid, ovate-oblong, oval with an extended anterior margin. The crown sculpture is represented by 4 to 9 short, not high, narrow ridges and wide not very deep grooves which show a slightly fan-shaped location. These are well defined at the anterior margin of the crown, but gradually fade out towards the middle part or a little farther beyond it. The grooves form something like a narrow border along the front margin of the crown. The posterior part of the crown is smooth. The neck of the scales is well marked. It is of medium height, relatively thick, smooth, rhomboid in plan. The anterolateral walls of the neck of some scales slightly below the midline may be penetrated by some few pores, two or three pores on each sides. A well-developed rim outlines a junction of the neck and base. The base is moderately or slightly convex, rounded-rhomboid, elongated oval, elliptical, usually does not extend beyond the anterior margin of the crown. The apex of the base is weakly expressed, usually slightly shifted forward.

Histology. In the crown has up to six growth lamellae. The anterior section of the crown is penetrated by abundant narrow dentine tubules branching at different levels with numerous lacunae. The mesodentine in the posterior part of the crown with large oriented lacunae (Stranggewebe according to W. Gross [31]) occupies the entire body of the growth lamellae. The system of radial, circular and ascending canals penetrating the mesodentine is well developed. The circular canals are large and clearly observed in the posterior part of the crown. The radial canals are wide, long, located above the surface of the base and directed towards the center of the scale. The ascending canals are long, weakly sinuous, in the neck area with not numerous narrow processes. There are large osteocytes in the neck. The osteocytes have short processes. The base is formed by the bone tissue and shows a moderate amount of osteocyte cavities. Sharpey's fibers are narrow, relatively long, indistinct.

Variability. The scales of this species vary in the crown shape, the base configuration and its convexity degree — from slightly to moderately convex. The crown sculpture show various number of ridges. The ridges may fade at different distances from the anterior margin of the crown, but its posterior part is always smooth.

Comparison. The scales of *Cheiracanthoides pinskensis* sp. nov. differ from those of *Cheiracanthoides comptus* Wells, 1944 [30; 32] in size, the smaller number of the ridges on the crown, their configuration, thickness and length, less dense network of the radial, circular and ascending canals in the crown, the pattern of the dentine tubule branching in the anterior part of the crown, the smaller number of the osteocyte cavities in the base of the scales. Distinct differences are determined between the species of *Cheiracanthoides proprius* Valiukevičius, 1985 [5] and *Cheiracanthoides pinskensis* sp. nov. A new species shows a not very large, slightly or moderately convex base not extending beyond the anterior margin of the crown. The posterior edge of the crown is straight, sometimes, slightly lowered. The crown sculpture is mainly characterized by the pattern of the ridges and something like a narrow border formed by the grooves located along the anterior margin of the crown. The crown shows up to six growth lamellae. The density, location and branching pattern of the dentine tubules in the crown of the scales are different. The radial, circular and ascending vascular canals are large and distinct. The base contains a slightly larger amount of the osteocyte cavities. The described new species differs from the species of *Cheiracanthoides rarus* Valiukevičius, 1994 [33] in the crown shape, less numerous ridges on the crown, their size and configuration, the neck size, a poor base convexity, a distinctly expressed system of radial, circular and ascending canals, different structure of the oriented mesodentine in the crown, the smaller number of the osteocyte cavities in the base of the scale. The scales of *Cheiracanthoides pinskensis* sp. nov. differ from the scales of *Cheiracanthoides borealis* Valiukevičius, 1994 [33] in the crown and base shapes, as well as in the crown sculpture. The latter is described by the presence of longer ridges and wider grooves between the ridges, as well as by the presence of something similar to a narrow border formed by

the grooves along the anterior margin of the crown. The main histological differences between the species described and *Cheiracanthoides borealis* Valiukevičius, 1994 [33] are a well-developed system of radial, circular and ascending canals that penetrate the mesodentine and the presence of the oriented mesodentine. The new species differs from the species of *Cheiracanthoides planus* Valiukevičius, 1998 [11] in the number of ridges on the crown, their thickness and length, as well as in some microstructure details. The described species differs from the species of *Cheiracanthoides nativus* Valiukevičius, 1998 [11] in the configuration and size of the ridges on the crown, size of the neck, poor or moderate convexity of the base, less dense dentine tubules in the crown, slightly less expressed large principal vascular canals, a smaller number of the osteocyte cavities in the base of the scale. The scales of *Cheiracanthoides pinskensis* sp. nov. are slightly similar to those of *Cheiracanthoides estonicus* Valiukevičius, 1998 [11]. However, their detailed comparison allows a number of distinctive features to be revealed. So, the scales of the new species described differ in a smaller number of ridges on the crown, their distribution pattern, absence of dichotomous branching ridges at the anterior margin of the crown, presence of something similar to a narrow border formed by the grooves along the anterior margin of the crown, poor to moderate convexity of the base, a different mesodentine structure with large oriented lacunae in the posterior part of the crown, a smaller number of osteocyte cavities in the base of the scales. The described species also differ from the species of *Cheiracanthoides wangi* Burrow, Turner et Wang, 2000 [34] in the smaller size of the scales, the crown shape, the larger crown thickness, the configuration, size and discernibleness of the ridges on the crown, a smaller neck height, much smaller base convexity, a weakly expressed apex, the structure of the oriented mesodentine in the crown, a different pattern of the dentine tubule location in the crown and some peculiarities of their branching, differently expressed radial, circular and ascending canals, a larger number of the osteocyte cavities in the neck and base. The scales of *Cheiracanthoides pinskensis* sp. nov. differ from those of *Cheiracanthoides dolosus* Burrow, Turner et Wang, 2000 [34] in a smaller size of the scales, a smaller number of the ridges on the crown, a fewer pores penetrating the neck of some scales, a smaller number of the growth lamellae, density of the dentine tubules in the crown, a well-developed system of the principal vascular canals, the number of the osteocyte cavities in the scale base. The new species differs from the species of *Cheiracanthoides mosolovicus* Valiukevičius, 2003 [35] in a larger size of the scales, the number of the ridges on the crown, their configuration and length, the presence of something like a narrow border along the crown anterior margin, the neck height and base size, the structure of the oriented mesodentine in the crown, differently expressed radial, circular and ascending canals, a slightly larger number of the osteocyte cavities in the neck and base.

Etymology. The name of the species was derived from the town of Pinsk in the vicinity of which the boreholes were drilled where the scales of this new acanthodian species were found in the core for the first time.

Geological age and geographical distribution. Middle Devonian, Eifelian Stage, Upper Substage, Narva Regional Superstage, Kostyukovichi Regional Stage; Belarus, Brest and Mogilev regions; Middle Devonian, Eifelian Stage, Veliky Most Subformation; Ukraine, Volyn region.

Occurrence. Near the town of Luninets, Luninets district, Brest region, Belarus, Pinsk 26 borehole, depth range of 420.1—422.4 m; northern outskirts of the village of Kormuzh, Luninets district, Brest region, Belarus, Pinsk 10 borehole, depth 245.2 m; north of the village of Gotsk, Soligorsk district, Minsk region, Belarus, Zhitkovichi 2 borehole, depth 191.0 m; near the village of Bolshaya Zimnitsa, Slavgorod district, Mogilev region, Belarus, Bykhov 1 borehole, depth range 201.4—202.4 m; southwestern outskirts of the village of Novostav, Volyn region, Ukraine, borehole № 6629, depth 180.5 m.

Conclusion. The re-examination of the previously collected scale material of the acanthodians from the deposits of the Kostyukovichi Regional Stage of Belarus allowed the author to distinguish and describe in detail both morphologically, and histologically a new species of

Cheiracanthoides pinskensis sp. nov. Some isolated scales of this species of an acanthodian fish were found in the carbonate-clayey deposits of shallow-sea origin. These sediments contain abundant different skeletal elements of both the invertebrates, and vertebrates. The described new species supplements the taxonomic composition of the ichthyofauna known from the deposits of the Upper Eifelian of the Middle Devonian of the west of the East European Platform.

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В статье на основе изолированных чешуй описан новый вид акантодовой рыбы *Cheiracanthoides pinskensis* sp. nov. из костюковичских отложений эйфельского яруса среднего девона Беларуси. Чешуйный материал по этому виду происходит в основном из керна четырех скважин, пробуренных на территории республики. Чешуи имеют хорошую сохранность. Они обнаружены в карбонатно-глинистых отложениях мелководно-морского генезиса. Эти образования достаточно часто содержат различные скелетные элементы как беспозвоночных, так и позвоночных. Описанный новый вид дополняет таксономический состав ихтиофауны, известной из отложений верхнего эйфеля среднего девона запада Восточно-Европейского кратона.

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