

therefore marked as *Acanthodes* sp. The mass occurrence of specimens on bedding surfaces is common there. Around 45 specimens of the various degree of preservation were detected on the unnumbered flag of carbonate in the Town Museum Nová Paka (Pl. 15A). Permian acanthodian specimens termed here as *Acanthodes* sp. pertain most likely to *Acanthodes gracilis*. Occurrence of *Acanthodes stambergi* n. sp. is questionable because this species is known from the uppermost part of the *Acanthodes gracilis* biozone for the time being. The Rudník Horizon is, however, of the lowermost *Acanthodes gracilis* biozone age. No indication of a third species was found out till now. Specimens from the Vrchlabí locality are both intensively deformed and carbonized. No measurements are therefore reliable. Various types of deformation (compression, dilatation, and shear) are notably well visible on the long elements as fin spines or mandibular bones. Both superficial and inner structures are missing due to carbonisation. Some specimens from the Rudník Horizon of the Krkonoše Piedmont Basin show signs of a chemical (?) degradation of the skeletal elements during fossilization (similar to scaumenellisation in sense of BÉLAND & ARSENAULT 1985). All skeletal elements known in *Acanthodes gracilis* and moreover basisphenoids were detected but their poor preservation do not allows a specific determination. Six specimens of *Acanthodes* sp. from diverse localities of the Rudník Horizon (except for Vrchlabí) yielded a strange sort of scales with central hollow in the crown (Pl. 8B). The circular hollow have rounded margin and bottom. Depth of the hollows varies. This sort of scales was found on the anal fin with surroundings (M 4485/C), caudal fins (M 4375, PUK-19), and on the trunk (M 4375, M 4393, M 4458, M 4485/B, M 4485/C). No hollows were found on the scales of sensory lines.

The scales with the central hollow were located in variously located foci on the body. The scales were therefore deformed by a disease with a high probability. The disease affects the inner tissue of the scale (like a caries) because the microsculpture of the outer vitrodentine layer is not eroded.

### 3. Paleogeography and important localities

Taxon *Acanthodes gracilis* is probably confined to the Asselian (Lowermost Permian) basins of the Bohemian Massif. This species was originally described by BEYRICH (1848) from the North Sudetic Basin in Poland (north border of the Bohemian Massif). The other presumable (and often mentioned) occurrences of the *Acanthodes gracilis* comes from the Austrian southernmost segment of the Boskovice Basin near Zöbing (VASICEK & STEININGER 1996), from the Saxo-Thuringian basins (e. g. the Thuringian Forest, the Saale Basin, the Weissig Basin, and the Saalhausen Basin) in Germany (north-western border of the Bohemian Massif). Redescription of the German and Polish specimens and taxonomic revision of the species *Acanthodes gracilis* is now being prepared by HEIDTKE and SCHNEIDER.

Other Asselian (and possibly also Sakmarian) species come from the Saar-Nahe Basin in Germany (*Acanthodes bronni*, *Acanthodes boyi*, *Acanthodes tholeyi*, *Westrichus kraetschmeri*) and the basins of the Massif Central in France (*Acanthodes bourbonensis*). The Asselian specimens named *Acanthodes* sp. are mentioned from New Mexico, Kansas, Oklahoma, and Texas (FOREMAN & MARTIN 1988, VAUGHN 1969). The youngest still known acanthodian is probably *Acanthodes luedersensis* from the Artinskian marine sediments (with continental fauna components as rare amphibian and reptilian remains) of Texas (DALQUEST, KOCURKO & GRIMES 1988).

Ten localities (Fig. 45) of the Bohemian and Moravian part of the Bohemian Massif yielded acanthodian specimens of all taxa capable of an approximation of the total specimen length:

- Černá Hora locality – 1 subadult specimen
- Kladoruby locality – 3 juveniles (14%), 16 subadults (76%), 2 adults (10%)
- Košálov localities – 2 juveniles (7%), 16 subadults (57%), 10 adults (36%)
- Kundratice locality – 3 juveniles (75%), 1 adult (25%)
- Padochov locality – 4 juveniles (29%), 9 subadults (64%), 1 adult (7%)
- Prostřední Lánov locality – 3 adult specimens
- Rudník locality – 1 subadult specimen
- Rybnice localities – 9 subadults (47%), 10 adults (53%)
- Zbraslavce locality – 1 adult specimen
- Zbýšov locality – 1 subadult specimen.

Proportions among the growth stages are rather close in the above mentioned localities. However, the Padochov locality shows a more substantial shift to younger stages and the localities Rybnice on the contrary to older stages. Data are, however, unquestionably distorted, particularly in older collections. Fully developed adult specimens were preferred there. Juvenile specimens with their weak squamation passed unnoticed or they were assumed to be a mere body fragments. Distribution of the computed ratios sorted on the basis of the localities is documented in the Fig. 46. All three taxa (including the indeterminable specimens labelled here as *Acanthodes* sp.) were found together only at the Kladoruby locality.

### 4. Conclusions

Bohemian and Moravian specimens of *Acanthodes gracilis* were investigated. A closely related species *Acanthodes stambergi* n. sp. was described. The new species differs from *Acanthodes gracilis* particularly in its extremely long dermatrichia of the pectoral fins. A similar couple of species (the dominant *Acanthodes bronni* and rare *Acanthodes tholeyi* with extraordinarily long pectoral dermatrichia) has been reported from the Saar-Nahe Basin in Germany (HEIDTKE 1990a, 1990b). Additional two rare species (*Acanthodes boyi* and *Westrichus kraetschmeri*) were described from the Saar-Nahe Basin later (HEIDTKE 1993, 2003).

Labyrinth infillings and otoliths were found in all three taxa. Overlapping of body scales and microsculptures of scale crowns were detected unlike ZIDEK's statement

| Locality                     | Taxon                       | Amt | A <sup>1</sup>  | A <sup>2</sup>  | B                 | C    | D <sup>1</sup> | D <sup>2</sup> | E   | F    | G    | H    | I    | J    | K                 |
|------------------------------|-----------------------------|-----|-----------------|-----------------|-------------------|------|----------------|----------------|-----|------|------|------|------|------|-------------------|
| Kladoruby                    | <i>Acanthodes gracilis</i>  | 9   | 50–(62)<br>56   | (59)            | (24)–(33)<br>28   |      |                |                |     |      |      |      |      |      | [25]–[26]<br>25,5 |
|                              | <i>Acanthodes stambergi</i> | 2   |                 |                 | [32]              |      |                |                |     |      |      |      |      |      | [28]              |
|                              | <i>Acanthodes</i> sp.       | 2   |                 |                 |                   |      |                |                |     |      |      |      |      |      | [13]              |
| Košállov, za hospodou        | <i>Acanthodes gracilis</i>  | 8   | (55)–(68)<br>62 | (50)–(59)<br>55 | (22)–[29]<br>27   | [15] | [10]           | [8]            | [4] | [46] | [32] | [23] | [19] | [10] | [24]              |
| Padochov                     | <i>Acanthodes gracilis</i>  | 7   | 67–73<br>70     | 59              | [15]–29<br>23     |      |                |                |     |      |      |      |      |      | 30                |
| Rybnice                      | <i>Acanthodes gracilis</i>  | 4   | [50]            |                 | [25]–[43]<br>32   |      |                |                |     |      |      |      |      |      |                   |
|                              | <i>Acanthodes</i> sp.       | 3   |                 |                 | [19]–29<br>24     |      |                |                |     |      |      |      |      |      |                   |
| Košállov, various localities | <i>Acanthodes gracilis</i>  | 2   |                 | (55)            | (24)              |      |                |                |     |      |      |      |      |      |                   |
|                              | <i>Acanthodes</i> sp.       | 1   |                 | (60)            | 27                |      |                |                |     |      |      |      |      |      |                   |
| Košállov, Kovářův mlýn       | <i>Acanthodes gracilis</i>  | 3   |                 |                 | (23)–[35]<br>29   |      |                |                |     |      |      |      |      |      |                   |
| Kundratice                   | <i>Acanthodes gracilis</i>  | 2   | [72]            |                 | [27]–[28]<br>27,5 |      |                |                |     |      |      |      |      |      |                   |
| Rudník                       | <i>Acanthodes gracilis</i>  | 1   |                 | (51)            | (26)              |      |                |                |     |      |      |      |      |      |                   |
| Zbýšov                       | <i>Acanthodes gracilis</i>  | 1   |                 |                 | [20]              |      |                |                |     |      |      |      |      |      |                   |

Fig. 46. Distribution of the computed ratios of the Permian acanthodians of the Czech Republic sorted on the basis of the localities. Amt – amount; Est – estimated; the exact and average values are out of parentheses; slightly imprecise values are in round brackets; inaccurate or questionable values are in square brackets; the ranges of values are given on tops of cells, the average ones at the bottoms.

(1985). The ontogenetic development (particularly the development of the squamation) was described especially in *Acanthodes gracilis*. Conventional boundaries (based on the real structures) were established for three main growth stages (juvenile, subadult, and adult). The total specimen size (based on a competent estimation) ranges from 61 to 567 mm. The lengths may be rather underestimated. On the other hand, some specimens were unquestionably smaller (50 mm or less).

Permian acanthodians were toothless planktonivorous forms of the 3<sup>rd</sup> trophic level (see BOY 1998, 2003, BOY & SCHINDLER 2000, ZAJÍC in preparation), distributed all over the world.

Strange areas of the scales that are deformed by shallow hollows were detected on various positions of the trunk and

fins. The deformation is probably caused by a scale dentine disease like a caries.

The uppermost part of the *Acanthodes gracilis* biozone was distinguished in the northern part of the Boskovice Basin. The basis for the distinction of the biozone uppermost part is the occurrence of *Acanthodes stambergi* n. sp. that is herein freshly separated from the nominal taxon of the biozone. The new species arose not long before the probably absolute extinction of acanthodians in the area of the Czech Republic. No acanthodian remains were found in the fossiliferous sediments of the ensuing *Xenacanthus decheni* biozone. The uppermost part of the *Acanthodes gracilis* biozone has not been described yet from the Krkonoše Piedmont and Blanice Basins. For stratigraphic details see ZAJÍC & ŠTAMBERG (2004).

| L         | M         | N         | O    | y       | Est L <sub>t</sub> |
|-----------|-----------|-----------|------|---------|--------------------|
| 62        | (59)      |           |      | 5-7     | 80-207             |
|           |           |           |      | (6)     | 133-198            |
|           | [58]      | [33]-[55] |      | 8,5-9   |                    |
|           |           | 44        |      |         |                    |
| [60]-[72] | [38]-[51] | [48]      | [11] | 6-9,5   | 78-257             |
| 67        | 46        |           |      |         |                    |
| [49]-84   | (46)-[88] | [68]-[95] |      | 12,5-14 | 71-186             |
| 68        | 62        | 82        |      |         |                    |
| [88]      |           |           |      | [10]    | 150-281            |
| [52]      | 54        |           |      | 5       | 157-232            |
| [69]      |           |           |      | 3       | 115-340            |
|           | 49        |           |      | 3,5     | 299                |
| [61]-67   |           |           |      |         | 160-242            |
| 64        |           |           |      |         |                    |
| [61]      | (50)      | [45]      |      | 11      | 63-263             |
|           | (40)      |           |      |         | 108                |
|           |           |           |      |         | 127                |

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