

A contribution to the knowledge of the silica-scaled chrysophytes in eastern Hungary

Příspěvek k poznatkům o chrysomonádách s křemitými šupinami ve východním Maďarsku

Magda Ř e z á ě o v á & Pavel Š k a l o u d

Department of Botany, Charles University, Prague, Benátská 2, CZ-128 01

Abstract

Six species of the genus *Mallomonas* (Synurophyceae) were identified by electron microscopy (EM) from three localities in eastern Hungary. The composition of this flora was characteristic for warm, eutrophic and alkaline waters. *Mallomonas acaroides*, *M. elongata*, *M. caudata* and *M. tonsurata* are common and widely distributed. *Mallomonas portae-ferreae* is one of the typical members of *Mallomonas* species in summer phytoplankton in Hungary. *Mallomonas peronoides* var. *bangladeshica* was recorded in Europe for the second time.

Introduction

Many records of the Hungarian chrysophyte flora were published during the 20th century. However, the most of them must be considered dubious, as they were based on light microscopy (LM). Recent investigations based on electron microscopy reported about 67 species of silica-scaled chrysophytes (BARRETO 2001, BARRETO et al. 2000, KISS & KRISTIANSEN 1994, KRISTIANSEN & PADISÁK 1992, PADISÁK et al. 2000, PÉTERFI et al. 1998 a, PÉTERFI et al. 1998 b). Nevertheless, the composition of chrysophyte flora of Hungary is still far from complete. The purpose of this study is to enlarge knowledge concerning occurrence of the scaled chrysophytes in summer phytoplankton of selected localities in eastern Hungary. The chrysophyte flora of this region was studied in detail by PÉTERFI et al. (1998 b.) They reported 26 taxa of silica-scaled chrysophytes from the Hortobágy National Park. PADISÁK et al. (2000) published some data from backwater of the Tisza River in south-eastern Hungary.

Material and methods

Phytoplankton samples were collected during the summer 2002 from twelve localities in Hungary using 40µm mesh-size net. Material was immediately concentrated using plastic membrane filter (Nalgene, 0.2 µm – Nalge Company, U.S.A) and subsequently fixed in Lugol's iodine solution. The

samples were investigated by light microscopy for the presence or absence of chrysophytes. Drops of positive material (from three localities) were transferred to formvar-coated grids, air-dried, shadow cast with chromium and examined by a transmission electron microscope Philips T 300.

The sampling sites, date of sampling and pH are listed below. pH was measured using pH indicator paper Whatman (Type CF, Whatman International Ltd.).

1. Lake between Poroszló village and Tisza River. Locality neighbours on the preserved area of the Hortobágyi National Park (July 19. 2002, pH 7 – 7.5).
2. Estuary of the Laskó River to the backwater near Sarud village, (July 20. 2002, pH 7 – 7.5)
3. Lake Tisza-tó near Sarud village (July 20. 2002, pH 7 – 7.5).

For detailed localisation see Fig 9.

Results and discussion

Mallomonas acaroides var. *acaroides* PERTY emend. IVANOV, (Figs 1, 2)

Many scales of this species were recorded in all localities. It is a widely distributed species, occurring mainly in eutrophic and alkaline waters. There are reports from many places in Hungary (BARRETO et al. 2000, PÉTERFI et al. 1998 b).

Mallomonas caudata IVANOV emend. KRIEGER

Some scales were found only in locality 2. It is a cosmopolitan species, occurring in a wide range of localities. There are many records from Hungary. Some of them are from LM observations, but in this case they can be considered correct (KRISTIANSEN & PADISÁK 1992).

Mallomonas elongata REVERDIN, (Fig. 3)

Only a few scales were observed in localities 1 and 2. According to SIVER (1991), this species prefers cold and slightly alkaline conditions. It was previously found in Hungary by PÉTERFI et al. (1998 a) and by PADISÁK et al. (2000).

Mallomonas peronoides var. *bangladeshica* TAKAHASHI & HAYAKAWA, (Figs 4, 5)

Only isolated scales were found in locality 2. Body scales of this species are very similar to those of *Mallomonas peronoides* var. *peronoides*, except for presence of the raised grapnel-like structure with 9-13 lobed arms (SIVER 1991). The scales with markedly developed grapnel-like appendage with 10–11 lobed arms were observed in our specimen. Additionally, we noted the presence of the anterior small depression between appendage and anterior border, as had been mentioned previously by SIVER & VIGNA (1996). The species has been recorded

mainly from tropical regions in Africa, Asia and South America (for further details see KRISTIANSEN 2002). It was identified for the first time in Hungary and in the Carpathic Basin.

Mallomonas portae-ferreae PÉTERFI & ASMUND var. *portae-ferreae*, (Figs 6, 7)
A lot of scales were recorded in localities 1 and 2. *Mallomonas portae-ferreae* is often found in tropical to subtropical regions. In temperate zones, the species appears more frequently in summer season and prefers alkaline water bodies. Based on EM investigations it was found in several places in Hungary (PADISÁK et al. 2000, PÉTERFI et al. 1998 a).

Mallomonas tonsurata TEILING em. KRIEGER, (Fig. 8)

Many scales of this species were found in all localities. The species prefers alkaline, slightly to strongly eutrophic water bodies. It is one of the species that is widely distributed in Hungary during the whole year (PÉTERFI et al. 1998 a).

In result, six species of scaled chrysophytes were identified during the investigation of three localities. All of them belong to the genus *Mallomonas*. The composition of investigated chrysophyte flora is characteristic for eutrophic and alkaline localities. Such localities (river backwaters, fishponds and other shallow water bodies) are very common in Hungary.

The most abundant species, *Mallomonas acaroides* var. *acaroides* and *M. tonsurata*, are widely distributed and cosmopolitan. *Mallomonas elongata* is classified as coldwater species with maximum occurrence below 9 °C (SIVER 1991). However, there are some records from water bodies at temperature exceeding 25 °C (PADISÁK et al. 2000, WUJEK et al. 1977). In the Czech Republic, some scales of this species were found in samples collected at 23 °C (ŘEZÁČOVÁ 2003). Obviously, *Mallomonas elongata* tolerates higher temperature, but never reaches high abundance. *Mallomonas portae-ferreae* is one of the characteristic species in summer phytoplankton of eutrophic lakes and river backwaters in Hungary. According to PADISÁK et al. (2000), Hungary is a part of the northern boundary of its distribution. Nevertheless, we observed this species in a shallow pond and a pool in the Czech Republic (ŘEZÁČOVÁ 2003). Based on a survey of the collections from Connecticut, SIVER (1991) noted that *M. portae-ferreae* had a much broader distribution with respect to temperature, ranging from 2 °C to 28 °C. It was sporadically found throughout the year. *Mallomonas peronoides* var. *bangladeshica* has never been recorded, not only from Hungary, but even from the Carpathic basin. In Europe, there was only one record of this species in summer phytoplankton in Portugal (CALADO & CRAVEIRO 1995). Therefore, the locality that is reported in this paper is the northernmost place of its occurrence. Only few ecological data were published for *Mallomonas peronoides* var. *bangladeshica*. It was reported from dystrophic

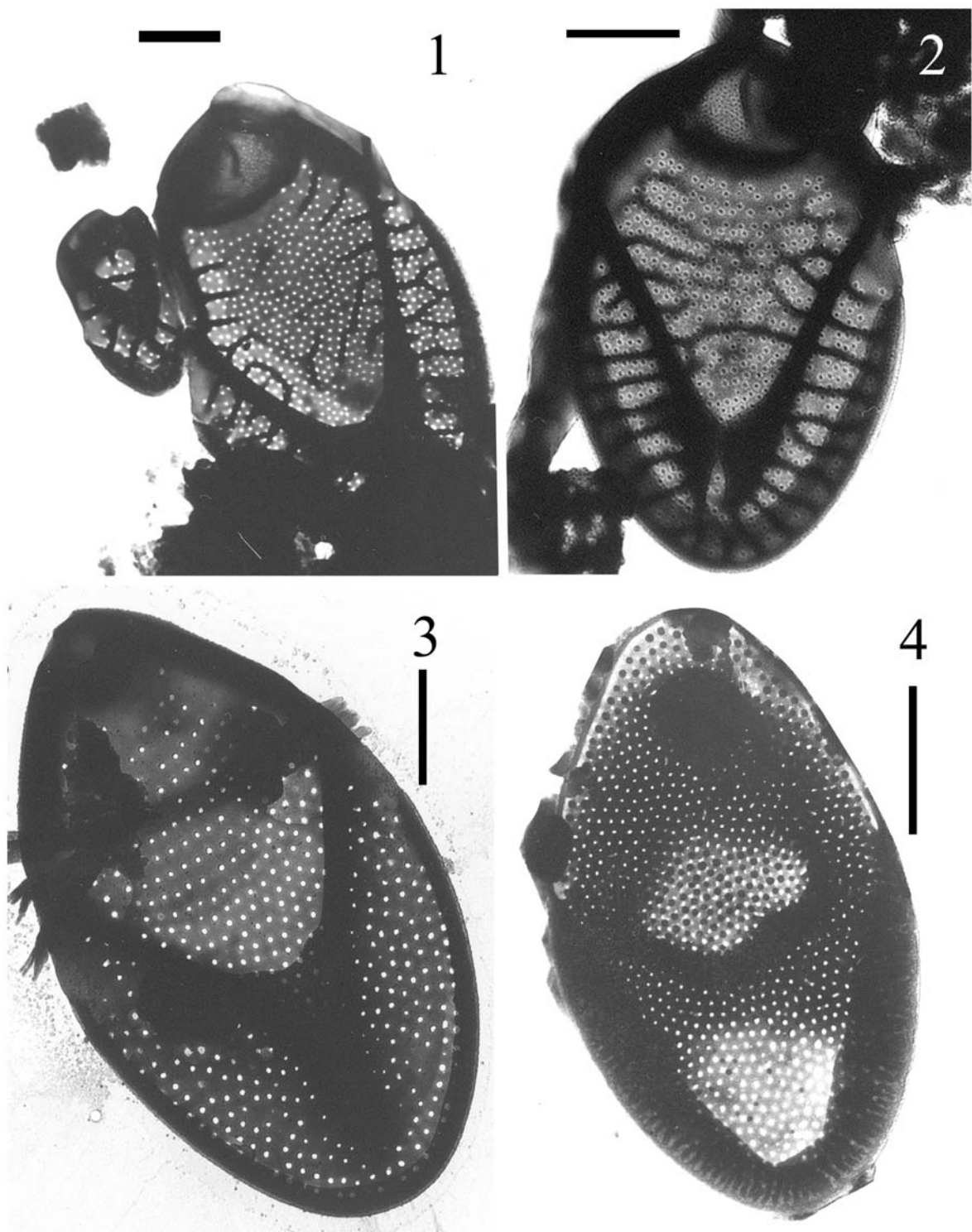
to eutrophic waters at about 30 °C and a pH range from 6.4 to 7.4 (CRONBERG 1996, SIVER & VIGNA 1996).

Acknowledgements

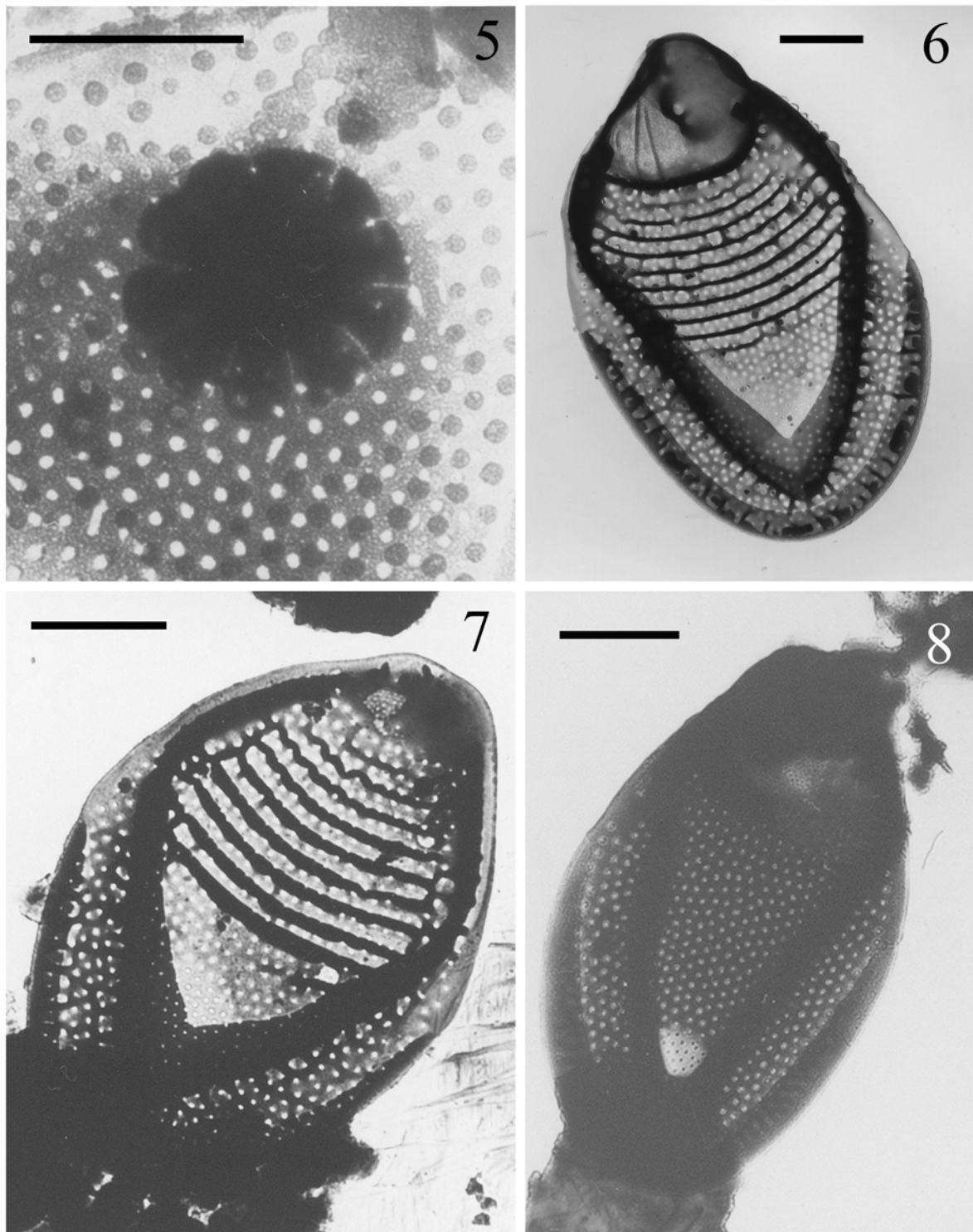
The authors are very grateful to T. Kalina for his assistance in electron microscopy and to J. Neustupa and Y. Němcová for valuable comments.

References

- BARRETO, S., KRISTIANSEN, J. & ÁCS, É. (2000): Silica-scaled chrysophytes during spring in the Kis-Balaton Reservoir, Hungary. – *Acta Bot. Croat.* 59(2): 337–349.
- BARRETO, S. (2001): Three new *Mallomonas* species (Synurophyceae) from a mountain area in North-Hungary. – *Nord. J. Bot.* 21(4): 437–447.
- CALADO, A. J. & CRAVEIRO, S. C. (1995): Notes on the ecology of Synurophycean algae found in Portugal. – *Nord. J. Bot.* 15: 641–654.
- CRONBERG, G. (1996): Scaled chrysophytes from the Okavango Delta, Botswana, Africa. – In: KRISTIANSEN, J. & CRONBERG, G. (1996): *Chrysophytes: Progress and New Horizons*. Beih. Nova Hedwigia 114: 91–108.
- KISS, K. T. & KRISTIANSEN, J. (1994): Silica-scaled Chrysophytes (Synurophyceae) from some rivers and shallow lakes in Hungary. – *Hydrobiologia* 289: 157–162.
- KRISTIANSEN, J. (2002): The genus *Mallomonas* (Synurophyceae) – A taxonomic survey based on the ultrastructure of silica scales and bristles. – *Opera Botanica* 139: 5–218.
- KRISTIANSEN, J. & PADISÁK, J. (1992): Silica-scaled chrysophytes (Chrysophyceae and Synurophyceae) from the Kis-Balaton Reservoir, Hungary. – *Annales Historico-Naturales Musei Nationalis Hungarici* 84: 7–16.
- PADISÁK, J., PÉTERFI, L. S. & MOMEU, L. (2000): Silica-scaled chrysophytes from Hungary. – *Verh. Internat. Verein. Limnol.* 27: 131–134.
- PÉTERFI, L. S., MOMEU, L., PADISÁK, J. & VARGA, V. (1998 a): Silica-scaled chrysophytes from permanent and temporary waters of Hortobágy, eastern Hungary. – *Hydrobiologia* 369/370: 339–351.
- PÉTERFI, L. S., PADISÁK, J., MOMEU, L. & BORICS, G. (1998 b): Silica-scaled chrysophytes from the bog-lake Baláta-tó, SW Hungary. – *Nord. J. Bot.* 18: 727–733.
- ŘEZÁČOVÁ, M. (2003): *Ekologie a rozšíření chrysomonád s křemitými šupinami (Chrysophyceae, Synurophyceae) [Silica-scaled chrysophytes – ecology and distribution (Chrysophyceae, Synurophyceae)]*. – Ms. [Bc thesis, depon. in: Dept. Bot. Charles Univ., Prague].
- SIVER, P. A. (1991): *The biology of Mallomonas: Morphology, Taxonomy and Ecology*. – 248 pp., Kluwer Academic Publishers, Dordrecht.
- SIVER, P. A. & VIGNA, M. S. (1996): Notes on species of *Mallomonas* in the series *Peronoides* (Mallomonadaceae, Synurophyceae). – *Nord. J. Bot.* 16: 223–231.
- WUJEK, D. E., GRETZ, M. & WUJEK, M. G. (1977): Studies on Michigan Chrysophyceae IV. – *Michigan Botanist* 16: 191–194.



Figs. 1 – 4: Scales of *Mallomonas*: 1-2 *Mallomonas acaroides* var. *acaroides*, body scales and extremely small rear scale; 3 *M. elongata*, body scale; 4 *M. peronoides* var. *bangladeshica*, body scale with grapnel-like appendage (Bars: Figs 1 - 4 = 1 μ m).



Figs. 5 – 8: Scales of *Mallomonas*: 5 *M. peronoides* var. *bangladeshica*, body scale with grapnel-like appendage; 6-7 *M. portae-ferreae*, dome-less and dome-bearing scales; 8 *M. tonsurata*, body scale (Bars: Fig. 5 = 0.5 μm , Figs 6 - 8 = 1 μm ,).

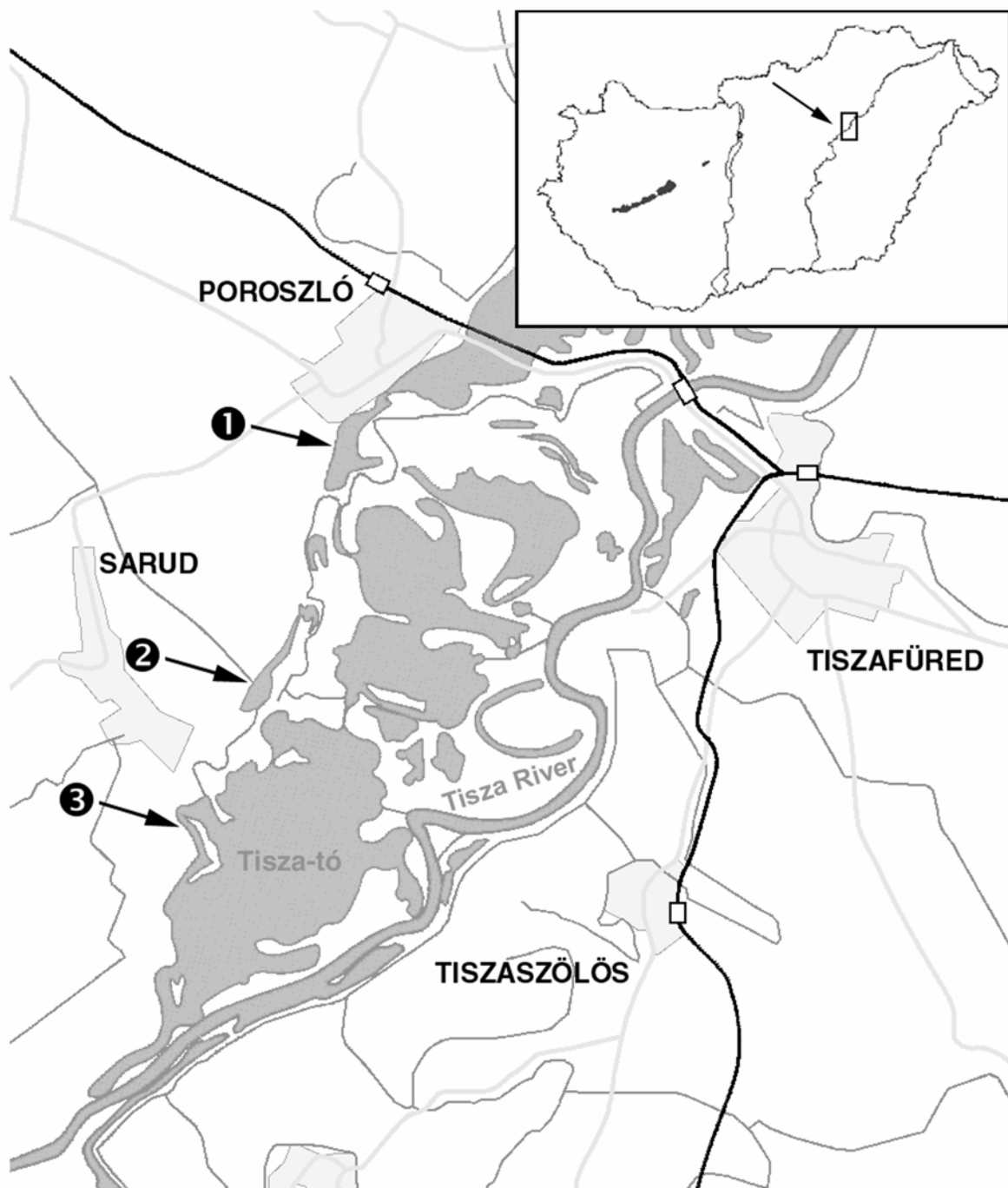


Fig. 9: Distribution of the sampling sites in investigated part of Hungary, as listed in Material and methods of this paper.