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ADDITIONS TO THE BRYOPHYTE FLORA OF HUNGARY FROM THE BRITISH BRYOLOGICAL SOCIETY MEETING IN APRIL 2024

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Abstract: During a meeting of the British Bryological Society in Hungary in April 2024, *Bryum touwii*, *Ceratodon conicus*, *Microbryum conicum*, *M. muticum*, *Pterygoneurum kozlovii* and *Tortella humilis* were recorded as new or confirmed members of the Hungarian flora. Details of the collections are given, and the diagnostic characters of the taxa are discussed. The concepts of the taxa in the *Microbryum davallianum*/*M. starckeanum* complex, as widely accepted in Central Europe, are presented in tabulated form.

Key words: *Bryum touwii*, *Ceratodon conicus*, *Microbryum*, mosses, *Pterygoneurum kozlovii*, taxonomy, *Tortella humilis*

INTRODUCTION

There have been many advances in our knowledge of Hungarian bryophytes during the present century, and especially since 2012, when a recording project was initiated with the ultimate aim of producing a distribution atlas for the country (Erzberger 2020). These advances are reflected in the most recent update to the national checklist (Erzberger and Papp 2020).

In April 2024, the British Bryological Society held a week-long meeting in Hungary, based in Budapest and Eger, and involving excursions to many representative habitats. During the meeting, several taxa were collected that were new or confirmed for the country. Details of these records are presented in the present paper.

In the citation of individual records, grid references of the Central European Mapping System (Bartha *et al.* 2015, Niklfeld 1971) are included in square brackets in the format nnnn.n for each locality.

Bryum touwii (Bijlsma, Kruijer et M. Stech) Jan Kučera

Pest County: [8279.2] Visegrád, forest in the surrounding of Visegrád castle, 47.79446° N, 18.98348° E (accuracy ≤ 12 m), *ca* 307 m a.s.l., on open ground at the edge of a rarely travelled forest path over silty-loamy soil, 9 April 2024, C. & Th. Schneider (Herb. Claudia & Thomas Schneider, Bryophyta 10435).

Bryum touwii was described in 2020 as *Ptychostomum touwii* by Bijlsma, Kruijer et M. Stech as an independent species (Bijlsma *et al.* 2020) and recently transferred to the genus *Bryum* by Jan Kučera (Kučera 2024). Previously, it had not been distinguished from *Bryum rubens* Mitt. (= *Ptychostomum rubens* (Mitt.) Holyoak et N. Pedersen).

The plants collected in the forest around Visegrád castle grow as solitary plants in open ground between other bryophytes of open, regularly disturbed places such as *Acaulon muticum* (Schreb. ex Hedw.) Müll. Hal., *Fissidens viridulus* (Sw.) Wahlenb., *Dicranella schreberiana* (Hedw.) Dixon and *Riccia sorocarpa* Bisch. They show the differentiating morphological characters described by Bijlsma *et al.* (2020), such as mostly intact older stems, leaves evenly arranged and not or weakly differing in shape along the stem, oblong-lanceolate, erecto-patent when moist, denticulate, gradually narrowed and recurved into the excurrent costa. The slender leaves compared to *Bryum rubens*, the conspicuously strongly excurrent, toothed costa and the toothed leaf margins were already noticeable with the hand lens (Fig. 1).

Erzberger and Papp (2020) did not mention the taxon, not described until 2020, in their updated checklist. The record from the forest in the surrounding of Visegrád castle confirms the presence of this species in Hungary.

Bijlsma *et al.* (2020) described the ecological conditions under which they observed the taxon as disturbed, neutral to slightly acidic, sandy-loamy soils. They reported that the species occurs in the Netherlands in "cover sand areas, including arable fields, but also in decalcified coastal dunes and sandy soil along the main rivers". Furthermore, they reported that *B. rubens* and *B. touwii* grow next to each other in locations intermediate in base and nutrient status. The site near Visegrád Castle in Hungary is located on the edge of a rarely used forest track. It is open to the ground and has at least superficially neutral base and nutrient conditions. It is thus ecologically similar to the habitat conditions described from the Netherlands.

Fig. 1. *Bryum touwii*: upper part of leaf and leaf tip. Scale bars = 100 μm.

Ceratodon conicus (Spreng.) Trevis.

Pest County: [8479.2] Remeteszőlős, Remete Gorge, 47.56057° N, 18.92981° E, *ca* 310 m a.s.l., on rocks in a steep gully of open ground within woodland, 8 April 2024, P. Martin (E, Herb. P. Martin).

The specimen from Remete Gorge shows the vegetative characters that are associated with *Ceratodon conicus* by Burley and Pritchard (1990). Specifically, these are the excurrence of the costa and its anatomy with regard to stereid bands, and the nature of the outer cell layer of the stem cortex. In *C. conicus* the costa is clearly excurrent (Fig. 2A), reaching 180 μm in the leaf illustrated, and it has a single, dorsal band of stereids as seen in transverse section (Fig. 2B). The stem cortex has a single thin-walled outer cell layer (Fig. 2C). In *Ceratodon purpureus* (Hedw.) Brid. the costa is usually only shortly excurrent and has both ventral and dorsal bands of stereids, while the stem section has two layers of

smaller, thicker-walled outer cells. However, the morphological characters of the stereid bands and the stem section have not been verified in a large number of samples, and they are not assessed in the recent study by NIETO-LUGILDE et al. (2018*b*). Instead, their study uses the number of stereid cells as one of their morphological characters. They do, however, state that *C. amazonum* Nieto-Lugilde, O. Werner, S. F. McDaniel et Ros, which they describe as a new species in their paper, lacks a ventral stereid band in the costa.

In order to verify the identity of the Hungarian specimen, a sample was tested by DNA barcoding at the Royal Botanic Garden, Edinburgh, using the nuclear ITS2 locus and plastid markers *rbc*L, *mat*K, *psb*A-*trn*H, *trn*L-*trn*F and *rpo*C1 (FORREST and HART 2023; data openly available from BOLD DS-OPENMOSS). Comparisons to three other *Ceratodon conicus* accessions from the UK (Preston DC41, Cambridge; O'Leary DC75, Buckinghamshire; Callaghan 69735, Glamorganshire; all included in the OPENMOSS database) are consistent with the identification of this specimen as *C. conicus* as it is recognised in the UK. The results of a BLASTn search of the NCBI database for the ITS2 and *trn*L-*trn*F markers reflect the complex situation described in NIETO-LUGILDE *et*

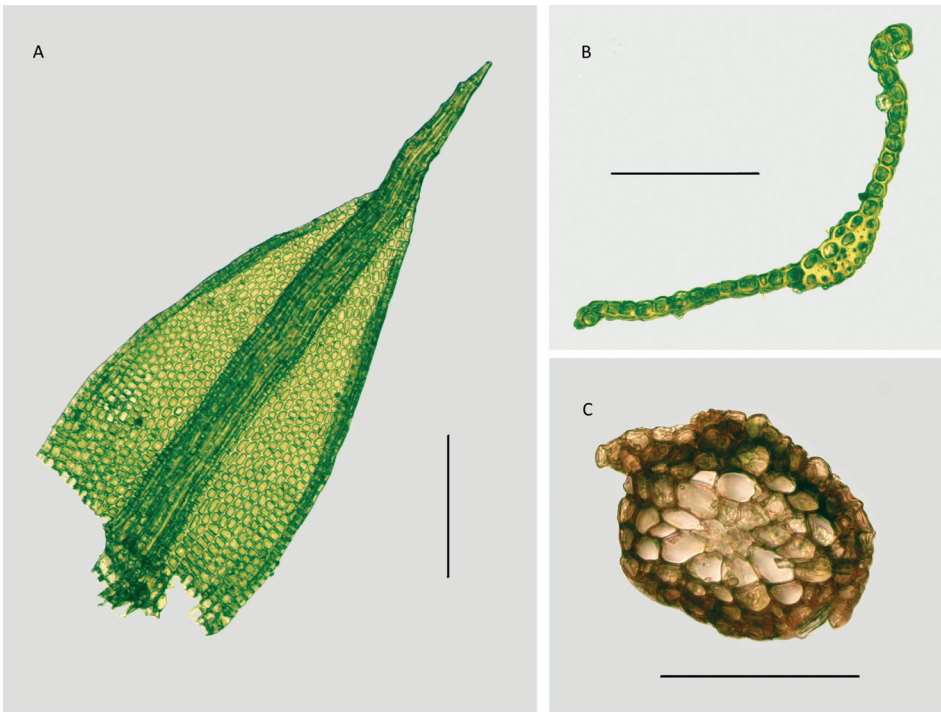

Fig. 2. *Ceratodon conicus*: A = leaf; B = section of costa; C = stem section. Scale bars: A = 200 μm, B, C = 100 μm.

al. (2018*a*, *b, c*); the top hits for both markers are accessions that are considered to be "recombinant" by Nieto-Lugilde *et al.* (2018*b*) so appear consistent with their concept of *Ceratodon* × *conicus*.

Erzberger and Papp (2020) excluded *C. conicus* from their updated checklist, noting that a record by van Zanten (1999) was based on sterile material and not safely identifiable based on knowledge of the species at that time. The specimen from Remete Gorge confirms the presence of this species in Hungary.

Ceratodon conicus is generally regarded as a calcicole and the bryophytes of the gully at Remete Gorge were indeed calcicolous, with *Homalothecium lutescens* (Hedw.) H. Rob. and *Syntrichia montana* Nees as immediate associates of *C. conicus*.

Microbryum conicum (Schwägr.) Cl. Schneid., Th. Schneid. et Mahévas (= *Microbryum davallianum* var. *conicum* (Schwägr.) R. H. Zander)

Pest County: [8980.2] along the road from Apaj to Kunszentmiklós, 47.086° N, 19.0962° E (accuracy ≤ 200 m), offenerdige Stellen in der Salzsteppe, *ca* 92 m a.s.l., 7 April 2024, C. & Th. Schneider (Herb. Claudia & Thomas Schneider, Bryophyta 10293, 10313, 10294), and S. Caspari (Herb. Caspari s.n.); same locality, 47.08717° N, 19.09844° E, on soil in saline grassland, 7 April 2024, P. Erzberger (B-Erzberger 29298).

Microbryum muticum (Venturi) Cl. Schneid., Th. Schneid. et Mahévas (= *Microbryum starckeanum* var. *brachyodus* (Bruch et Schimp.) R. H. Zander)

Pest County: [8279.2] Nagymaros, Szürke-hegy, 47.7702° N, 18.9364° E, Löss-übererdete Andesitfelsen, 105–185 m a.s.l., 9 April 2024, C. & Th. Schneider (Herb. Claudia & Thomas Schneider, 10377 Bryophyta).

Erzberger and Papp (2020) accepted three taxa for Hungary in the *Microbryum davallianum / starckeanum* complex: *M davallianum* (Sm.) R. H. Zander, *M. muticum* and *M. starckeanum* (Hedw.) R. H. Zander. Two taxa of the complex (as cited above) were observed during the BBS meeting, providing a first report of *M. conicum* in Hungary and confirming the presence of *M. muticum*. These specimens prompted the second and third authors (CS and TS) to review the taxonomic concepts widely accepted by Central European bryologists for this species group.

Species of the *Microbryum davallianum / starckeanum* complex are well characterised by (i) the stegocarpous capsule, in which the lid detaches from the urn at maturity, (ii) a conical to mamillate lid, (iii) a 2–3(–4.5) mm long seta, (iv) elongated-lanceolate, entire to slightly crenulate leaves with recurved leaf margins, (v) a more or less clearly excurrent costa terminating as a mucro, (vi) round-

ish-quadrate to hexagonal or short rectangular, mostly distinctly papillose cells (often opaque due to the papillae), 6–15 μm wide in the upper third of the leaf. This combination of characters distinguishes them from similar species such as *Tortula lindbergii* Broth. (*Pottia lanceolata* (Hedw.) Müll. Hal.), *Tortula truncata* (Hedw.) Mitt. (*Pottia truncata* (Hedw.) Bruch et Schimp.) or *Tortula caucasica* Broth. (*Pottia intermedia* (Turner) Fürnr.). If in doubt, a KOH test can help: the lamina of species of the genus *Microbryum* turns red in KOH. In the field, the plants stand out due to their small, loose turfs or patches with the typical brownish green to reddish brown colour.

While the species group *per se* is well-delimited and accepted, the taxa within the group have been evaluated very differently. Treatments vary from the recognition of four taxa at species level (Ahrens in Nebel and Philippi 2000, Frahm and Frey 2004, Meinunger and Schröder 2007, Lüth 2019, 2021), or at infraspecific level (Chamberlain in Smith 1980), to the differentiation of only two taxa at species level with no infraspecific taxa (Smith 2004, Guerra *et al.* 2006).

At least in Central Europe, four taxa can be well distinguished. The species concepts are presented below (Table 1). They are essentially based on the shape of the capsule, the capsule mouth, the development of the peristome teeth, the shape of the cells immediately below the capsule mouth, and the morphology of the spores.

Pterygoneurum kozlovii Laz.

Pest County: [8980.2] along the road from Apaj to Kunszentmiklós, 47.08561° N, 19.10046° E, soil patch in saline-alkaline grassland, *ca* 92 m a.s.l., 7 April 2024, Blockeel 53/239 (Herb. Blockeel); along the road from Apaj to Kunszentmiklós, 47.08561° N, 19.10053° E, open saline grassland, on dry soil crust, 93 m a.s.l., 7 April 2024, D. G. Long 47984 (E, BP); Pest County: along the road from Apaj to Kunszentmiklós, 47.086° N 19.0962° E, (accuracy ≤ 200 m), Offenerdige Stellen in der Salzsteppe, 92 m, 7 April 2024, C. & Th. Schneider (Herb Claudia & Thomas Schneider, Bryophyta 10291), Pest County, saline-alkali area at Apaj, *Artemisio Festucetum*, 47.084889° N, 19.097778° E, 110 m a.s.l., 10 April 2022, Papp, B. (BP 198673), 25 March 2023, Papp, B. (BP 198674), 26 March 2024, Papp, B. (BP 198675).

The collecting site of the sixth author (BP) is a bryophyte sampling plot of the Hungarian Biodiversity-monitoring System (Papp *et al.* 2005, 2006). The size of the plot is 10 m × 10 m, which was selected and permanently marked in 2002. Twenty-five 0.25 m^2-sized quadrats were placed regularly at the corners of a grid of 2 m spacing within the plots. In each quadrat, the presence of bryophyte spe-

Table 1. Central European concepts of taxa in the *Microbryum davallianum / starckeanum* complex, and their differentiating characters.

	Microbryum davallianum (Sm.) R. H. Zander	***Microbryum conicum*** (Schwägr.) Cl. Schneid., Th. Schneid. et Mahévas	***Microbryum muticum*** (Venturi) Cl. Schneid., Th. Schneid. et Mahévas	***Microbryum starckeanum*** (Hedw.) R. H. Zander
Shape of the deoperculate capsule (important: several capsules should be assessed)	not or slightly longer than wide, widest at the capsule mouth	longer than wide, widest just above the middle of the capsule	clearly longer than wide, widest at the middle of the capsule	clearly longer than wide, widest at the middle of the capsule
Capsule mouth	very wide-mouthed	narrow-mouthed to moderately wide-mouthed	narrow-mouthed, clearly constricted	narrow-mouthed, clearly constricted
Development of the peristome teeth (always make a longitudinal section of the capsule and examine the section from the inside)	completely absent	teeth very short, rudimentary, not or only slightly protruding above the capsule mouth; the teeth (or their stumps) often only visible from the inside of the capsule mouth	teeth short, rudimentary, only slightly or not protruding beyond the capsule mouth; rarely only very rudimentary, and then only visible from the inside of the capsule mouth (as with *M. conicum*)	teeth well-developed, clearly protruding above the capsule mouth, up to 200 μm long
Shape of the cells immediately below the capsule mouth	1(–2) rows of small cells with (slightly) thickened walls and with quadrate(-roundish) lumens	1(–2) rows of cells with moderately thickened walls and roundish lumens, sometimes accompanied by 1–2 rows of cells with thickened walls ('transitional rows')	(1–)2–4 rows with more strongly thickened walls and roundish lumens, transitional cell rows not or less distinct	(1–)2–4 rows with more strongly thickened walls and roundish lumens, transitional cell rows not or less distinct
Spores	densely covered with rather long spines (echinate)	papillose to shortly spinose	papillose with low papillae	with coarse wart-like papillae, often in the form of rounded protuberances; resembling ripe blackberries

Table 1. continued

	Microbryum davallianum (Sm.) R. H. Zander	***Microbryum conicum*** (Schwägr.) Cl. Schneid., Th. Schneid. et Mahévas	***Microbryum muticum*** (Venturi) Cl. Schneid., Th. Schneid. et Mahévas	***Microbryum starckeanum*** (Hedw.) R. H. Zander
Ecology	open, well-illuminated areas on marl or base-rich clay, sandy marl (and loess), especially in arable fields, fallow fields, and more rarely on open patches in meadows and grasslands, very rarely in open patches of soil in other habitats	open, well-illuminated areas on base-rich or calcareous marl, sandy marl and loess; prefers nutrient-rich or electrolyte-rich, calcareous substrates; often in sites with a good supply of nutrients, in gardens, arable fields, and on open patches in grassland; strongly favours gardens; in drier sites than *M. davallianum,* hitherto absent from shallow soil on very dry, rocky sites such as those colonised by *M. muticum*	open, well-illuminated sites on skeletal, very shallow soil over basic or calcareous bedrock; on soil-covered rocks and rocky banks, in primary limestone habitats, dry grasslands, and rarely on wall-tops	base-rich or calcareous, open, well-illuminated sites; hitherto observed primarily in arable or fallow fields; overall the rarest species of the group
Bryo-sociology	character species of the *Pottietum davallianae*	in the nitrophytic, dry wing of Phascion cuspidatae	character species of the Phascion mitraeformis	[too few vegetational records of this very rare species to indicate its sociological association]
Synonyms (selected)	*Pottia davalliana* (Sm.) C. E. O. Jensen, *Pottia minutula* (Schwägr.) Fürnr. ex Hampe, *Pottia starkeana* subsp. *minutula* (Schwägr.) D. F. Chamb.	*Pottia conica* (Schwägr.) Nyholm, *Microbryum davallianum* var. *conicum* (Schwägr.) R. H. Zander, *Pottia davalliana* var. *conica* (Schwägr.) Podp., *Pottia starckeana* subsp. *conica* (Schwägr.) D. F. Chamb.	*Pottia mutica* Venturi, *Microbryum starckeanum* var. *brachyodus* (Bruch et Schimp.) R. H. Zander, *Pottia starckeana* var. *brachyoda* (Bruch et Schimp.) Müll. Hal.	*Pottia starkeana* (Hedw.) Müll. Hal.

Table 1. continued

	Microbryum davallianum (Sm.) R. H. Zander	***Microbryum conicum*** (Schwägr.) Cl. Schneid., Th. Schneid. et Mahévas	***Microbryum muticum*** (Venturi) Cl. Schneid., Th. Schneid. et Mahévas	***Microbryum starckeanum*** (Hedw.) R. H. Zander
Conceptual synonyms (selected) Symbols: ≡ ... is equivalent to < ... is included in <> ... excludes	≡ *Pottia davalliana* sensu Corley *et al.* (1981) ≡ *Pottia starkeana* subsp. *minutula* (Schwägr. ex Schleich.) D. F. Chamb. sensu Smith (1980) ≡ *Pottia davalliana* sensu Ahrens in Nebel and Philippi (2000) ≡ *Pottia davalliana* sensu Frahm and Frey (2004) ≡ *Pottia davalliana* sensu Meinunger and Schröder (2007) ≡ *Microbryum davallianum* sensu Lüth (2019, 2021) ≡ *Microbryum davallianum* var. *davallianum* sensu Hodgetts *et al.* (2020) < *Pottia davalliana* sensu Frey *et al.* (1995) < *Pottia davalliana* sensu Hill *et al.* (2006)	≡ *Pottia starkeana* subsp. *conica* sensu Smith (1980) ≡ *Pottia conica* sensu Ahrens in Nebel and Philippi (2000) ≡ *Pottia conica* sensu Frahm and Frey (2004) ≡ *Pottia conica* sensu Meinunger and Schröder (2007) ≡ *Microbryum conicum* sensu Lüth (2019, 2021) ≡ *Microbyum davallianum* var. *conicum* sensu Hodgetts *et al.* (2020) < *Pottia davalliana* sensu Corley *et al.* (1981) < *Pottia davalliana* sensu Frey *et al.* (1995) < *Microbryum davallianum* sensu Hill *et al.* (2006)	≡ *Pottia mutica* sensu Ahrens in Nebel and Philippi (2000) ≡ *Pottia mutica* sensu Frahm and Frey (2004) ≡ *Pottia mutica* sensu Meinunger and Schröder (2007) ≡ *Microbryum muticum* sensu Lüth (2019, 2021) ≡ *Pottia starkeana* var. *brachyodus* sensu Smith (1980) < *Pottia davalliana* sensu Corley *et al.* (1981) < *Pottia davalliana* sensu Frey *et al.* (1995) < *Microbryum starckeanum* sensu Hill *et al.* (2006) < *Microbryum davallianum* sensu Hodgetts *et al.* (2020) <> *Microbryum davallianum* var. *commutatum* sensu Hodgetts *et al.* (2020)	< *Pottia starckeana* sensu Frey *et al.* (1995) ≡ *Pottia starckeana* sensu Ahrens in Nebel and Philippi (2000) ≡ *Pottia starckeana* sensu Frahm and Frey (2004) ≡ *Pottia starckeana* sensu Meinunger and Schröder (2007) ≡ *Microbryum starckeanum* sensu Lüth (2019, 2021) ≡ *Pottia starkeana* var. *starkeana* sensu Smith (1980) ≡ *Microbryum starckeanum* sensu Hodgetts *et al.* (2020) < *Microbryum starckeanum* sensu Hill *et al.* (2006)

cies was recorded. The survey was repeated in each year, from 2002 (Ódor *et al.* 2013). *Pterygoneurum kozlovii* appeared in the plot for the first time in 2021 in two quadrats, but mature sporophytes were not detected; therefore, it was named as *Pterygoneurum* sp. In 2022 the species appeared with sporophytes in four quadrats, in 2023 in nine and in 2024 in ten quadrats, respectively. It can be concluded that the species has become more frequent in the plot during recent years.

The specimens collected during the British Bryological Society meeting resembled *Tortula acaulon* (With.) R. H. Zander var. *pilifera* (Hedw.) R. H. Zander in the field and were initially thought to belong to that taxon, having cleistocarpous capsules and leaves with a long hyaline hair-point. However, subsequent microscopic examination revealed the presence of lamellae on the ventral surface of the costa (Fig. 3A–D), indicating the genus *Pterygoneurum*. The only cleistocarpous species of the genus in Europe is *P. kozlovii*. The Hungarian plants were senescent at the time of collection, with the perichaetial leaves discoloured and in many cases eroded, thus limiting the observations that could be made. However, they closely match the description of 'typical *P. kozlovii*' in the study by Pisarenko (2006). In the shoots examined, the upper/perichaetial leaves are broadly ovate, concave, the lamina to 2 mm long, and the hair-point reaching 1 mm long, remotely and weakly spinulose. The lamellae are arranged in 2(–3) rows, often unevenly developed in the separate rows, the lamellae in a row sometimes consisting of two separate plates aligned end to end. They are variable in their development but may reach 10 cells high (Fig. 3C), as noted by Pisarenko in some of the specimens that she examined. The cells of both the lamellae and the upper leaf cells are sometimes smooth but often have mamillose or papillose projections; on the leaf lamina they are confined to the dorsal surface and never densely crowded (Fig. 3D). The projections are single or bifurcate, often hollow, and then appearing to be C- or O-shaped in surface view. The median leaf cells are quadrate to shortly rectangular (or hexagonal-rectangular), and a little larger than the dimensions given by Pisarenko, up to 20 μm wide and 38 μm long.

Some of the capsules in the Hungarian specimens were already disintegrating at the time of collection, and most were in a fragile condition. It was therefore easy to confirm their cleistocarpous nature and the absence of a deciduous lid. Pisarenko (2006) describes the capsule of typical *P. kozlovii* as lacking what she terms 'marker cells' in the position of the annulus but her illustrations (Fig. 5H–J) show 2–3 rows of smaller, ± quadrate cells below the capsule beak, and very similar cells are present in the Hungarian material (Fig 3E). The capsules are up to 0.9 mm in diameter, on a seta 0.2–0.3 mm long, and with a well-defined beak *ca* 0.2 mm long. The calyptra is cucullate.

The leaf lamellae and cleistocarpous capsules render *P. kozlovii* readily identifiable. *P. subsessile* (Brid.) Jur., which is widespread in parts of southern and

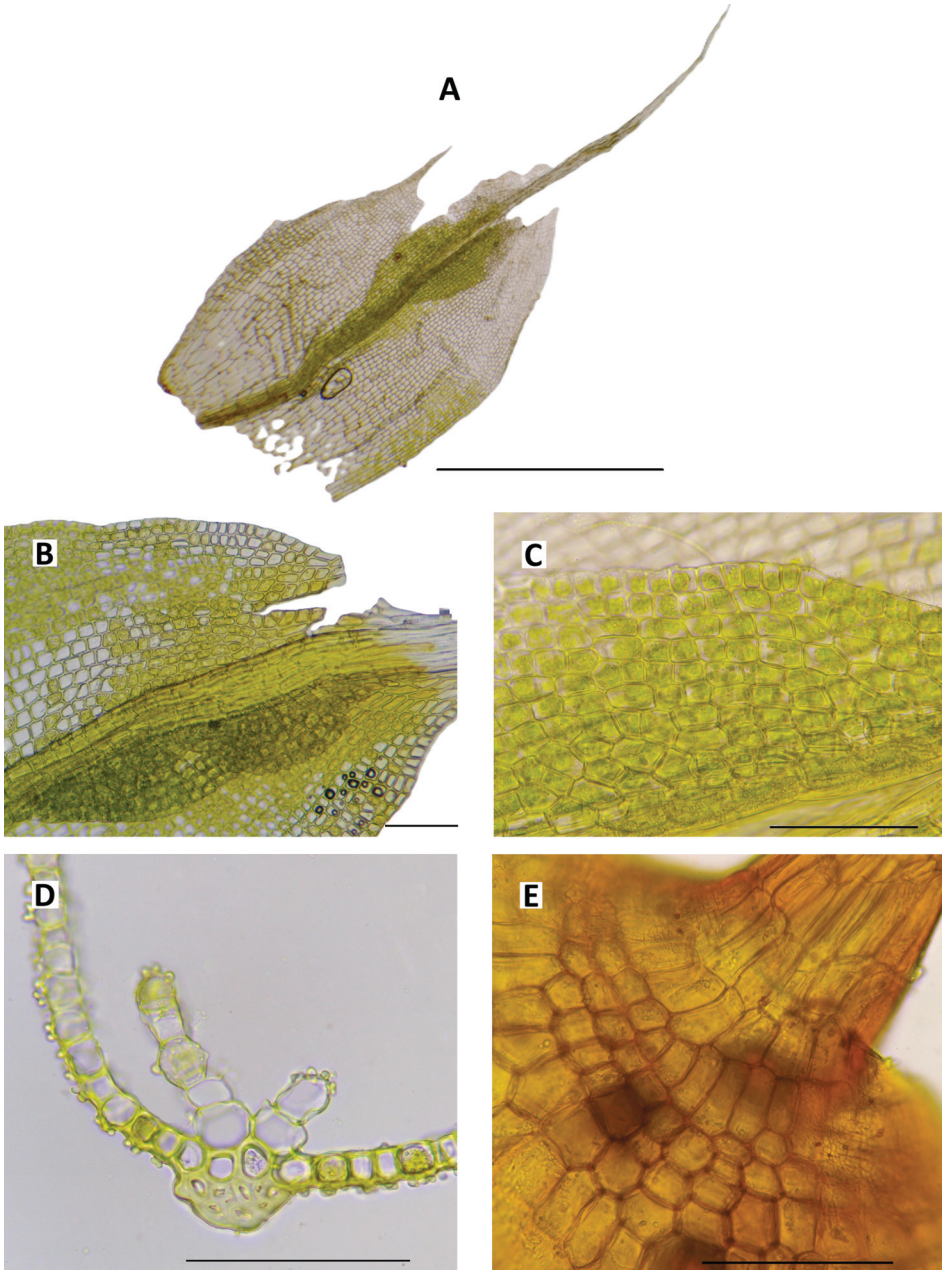

Fig. 3. *Pterygoneurum kozlovii*: A = partly eroded perichaetial leaf, with flattened lamellae visible; B = closer view of flattened lamellae; C = side view of a single lamella; D = cross section of leaf, showing lamellae and dorsal papillae; E = cells at base of capsule beak. From Blockeel 53/239. Scale bars: A = 1 mm, B, C, D, E = 100 μm.

eastern Europe (and also occurs in Hungary) has immersed capsules but differs in having a mitrate calyptra and a deciduous lid with a clear line of demarcation from the urn. After the fall of the lid, the capsules are wide-mouthed, almost hemispherical in shape, and persistent. In addition, the leaves tend to have four rows of lamellae, and the length of the hair-point is usually longer than the length of the leaf lamina. Typical plants of the two species are clearly distinct. However, Pisarenko (2006) found much variation among specimens collected in Altaisky Territory in southern West Siberia. These included (1) plants which resembled *P. kozlovii* in the reduced development of the costal lamellae and in having a shorter hair-point, but which had deciduous capsule lids, and (2) plants similarly resembling *P. kozlovii* in gametophyte characters, and with cleistocarpous capsules, but with a clear line of demarcation between the urn and 'lid'. Pisarenko also reports one instance of two individual plants with abnormal capsules growing among *P. subsessile* and on shoots similar to those of the latter species. These capsules were cleistocarpous, without any differentiation of lid or beak.

It is possible that hybridisation is one cause of abnormal sporophytes in these *Pterygoneurum* species, but Pisarenko also suggests that the later stages of sporophyte ontogenesis might be blocked by toxic concentrations of potassium chloride. The status of such forms might eventually be resolved by molecular analysis. They have apparently not been reported in Europe and no abnormalities were observed in the Hungarian population. Material of *P. subsessile* seen later during the BBS meeting at Nagymaros was clearly distinct.

Pterygoneurum sibiricum Otnyukova from Siberia is cleistocarpous and has many characters in common with *P. kozlovii* (Otnyukova 2020). Its status is uncertain. The lamellae are described as 4–10(–15) cells high, slightly exceeding the height observed in Hungarian plants, and it has stronger papillae on the lamellae and leaf lamina, with papillae present on both the dorsal and ventral surfaces of the lamina. However, strong papillae are sometimes present in Hungarian plants (Fig. 2D), and Otnyukova (2020) states that the leaf papillae of *P. sibiricum* are located mainly on the dorsal side of the lamina, and "in all studied specimens of *P. sibiricum* the number of papillae varies from one cell to another and from one leaf to another". On the other hand, the spores of *P. sibiricum* at (32–)37–45(–47) μm are somewhat larger than those of *P. kozlovii*, although spore diameters up to 38(–40) μm have been observed in the Hungarian plants. According to Otnyukova, *P. sibiricum* has a paroicous inflorescence (vs autoicous in *P. kozlovii*), but perigonial bracts are described and figured in the protologue, implying that the antheridia are enclosed in bud-like perigonia rather than naked in the leaf axils. Perigonia are said to be often situated near the archegonia in *P. sibiricum*, but remote from the perichaetia in *P. kozlovii*. Because of the senescent condition of the Hungarian plants, we have been unable to confirm the structure

and position of the perigonia. However, the apparent variability in the diagnostic characters of the two taxa raises the possibility that they belong to a single rather variable species.

Pterygoneurum kozlovii is a very rare moss in Europe, where it is confined to the continental interior. It was first described from Ukraine (Lazarenko 1946), and there are a few sites in Central and SE European Russia and in Moldova (Hodgetts and Lockhart 2020, Ignatov *et al.* 2006). *P. smardaeanum* Vaněk from Slovakia (Vaněk 1952) is considered synonymous with it. Wallfisch (2001) reported a locality in Romania, and there is a recent record from the margins of a saline lake in Austria (Zechmeister and Kropik 2024). A report from the Czech Republic (Kučera *et al.* 2017) was based on sterile material and remains unconfirmed. The species is similarly rare across other parts of the northern hemisphere, where its distribution is very fragmented. However, McIntosh (1989) reported it to be fairly common in shrub-steppe in southern British Columbia, Canada.

The presence of *P. kozlovii* on a saline-alkaline substrate is consistent with its reported ecology elsewhere. It is generally considered to be a halophyte.

Tortella humilis (Hedw.) Jenn.

Bács-Kiskun County: [9182.2] Kiskunság National Park, near Fülöpháza, 46.86548° N, 19.42114° E, on alkaline sandy soil on bank in sand steppe, 110 m a.s.l., 7 April 2024, Blockeel 53/243, dupl. BP 198676.

A tuft of *Tortella* with sporophytes was found at Kiskunság and collected because of its fertile state. On subsequent examination under the microscope, antheridia were detected in gemmiform buds on the sporophyte-bearing shoots (Fig. 4A). This immediately suggested that the specimen belonged to *Tortella humilis*, which is the only European species of the genus with an autoicous sexual condition. The gametophytes are rather small, reaching *ca* 6 mm tall in dry condition, but are consistent morphologically with *T. humilis*: stem central strand present (Fig. 4D); leaves lanceolate to linear-lanceolate with a broadly to narrowly acute apex, costa excurrent as a mucro; ventral surface of costa with quadrate, papillose cells (Fig. 4B), occasionally with a few elongate cells exposed; dorsal surface of costa with linear cells extending to the apex, individual cells partly with apical spines; basal cells of lamina hyaline, thin-walled, forming a V-shaped group but with a gradual transition to the upper cells, except along the margin (Fig. 4C); median and upper cells of leaf lamina small, quadrate, 6–10 μm wide, strongly papillose; perichaetial leaves similar to lower leaves.

Boros (1953, 1968) reported that previous records of *Tortella caespitosa* (Schwaegr.) Limpr. (a synonym of *T. humilis*) belonged to *T. inclinata* (R. Hedw.) Limpr. Therefore, Erzberger and Papp (2004) excluded *T. humilis* from the bry-

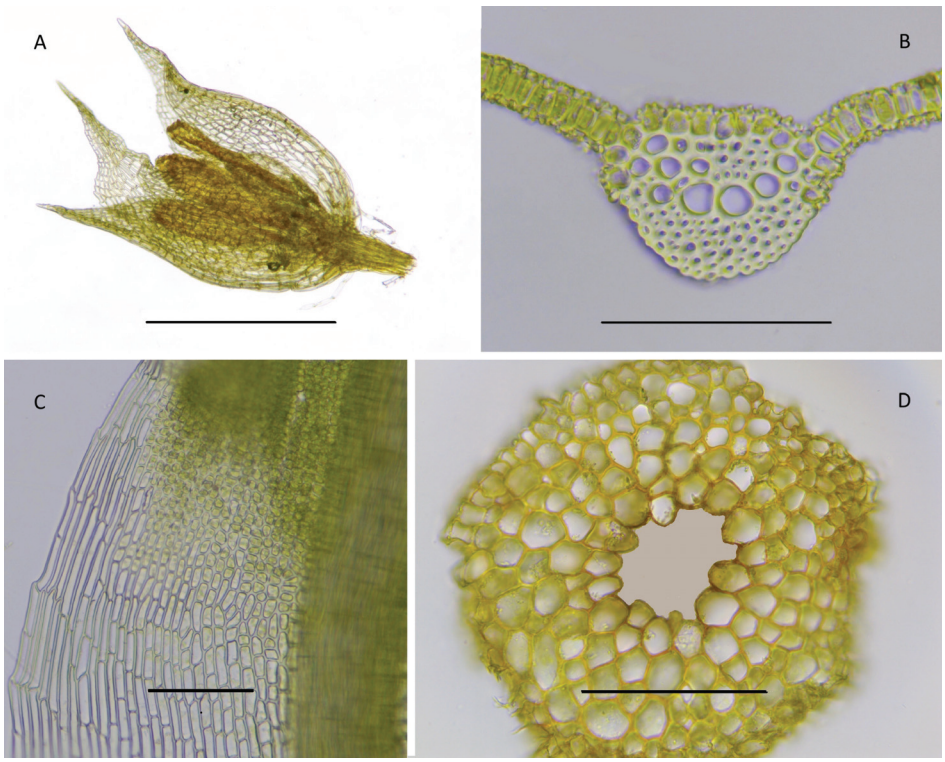

Fig. 4. *Tortella humilis*: A = androecium in form of axillary bud, from fertile shoot; B = section of costa, with papillose ventral surface; C = basal cells of leaf, showing gradual transition to upper cells in median and paracostal zones; D = stem section, with eroded central strand. From Blockeel 53/243. Scale bars: A = 1 mm, B, C, D = 100 μm.

ophyte flora of Hungary. It is a thermophilous moss, widely distributed in southern Europe, N Africa and SW Asia. It is rare north of the Alps, reaching northern Switzerland (Swissbryophytes 2025) and central Germany (Meinunger and Schröder 2007). It is present in most of the Balkan territories, north to Slovenia and Romania (Hodgetts and Lockhart 2020), and in eastern Europe extends to Ukraine (including the Carpathian part) and the South Urals in Russia (Ignatov *et al.* 2006). Its occurrence in Hungary, therefore, falls within the wider range of the species, but near its northern limits.

* * *

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Összefoglaló: 2024 áprilisában az Angol Mohász Társaság Magyarországon rendezte meg a tavaszi terepi konferenciáját. A kirándulások során több mohafajt sikerült először kimutatni Magyarországon, illetve egyes fajok jelenlétét bizonyítani az országban. Ezek a következők: *Bryum touwii*, *Ceratodon conicus*, *Microbryum conicum*, *M. muticum*, *Pterygoneurum kozlovii* and *Tortella humilis*. A gyűjtési adatok, a fajok meghatározását, elkülönítését segítő bélyegek kerülnek bemutatásra a cikkben. A *Microbryum davallianum* / *M. starckeanum* complex fajainak a Közép- Európában elfogadott koncepció szerinti elkülönítéséhez egy táblázat is készült.

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