



Atlas Florae Europaeae notes 23. The typification and revised taxonomic circumscription of *Sorbus bakonyensis* (Rosaceae), with a description of *Sorbus udvardyana*, a new apomictic species endemic to Hungary

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Abstract

The taxonomic and nomenclatural history of Jávorka's *Sorbus bakonyensis* is surveyed and its correct authorship and bibliographic citation is provided. The identity of the original material of *S. bakonyensis* and the history of its interpretations are discussed. The name *S. bakonyensis* is applicable to an endemic of the eastern Bakony Mountains, restricted to the vicinity of the village of Márkó in Hungary. The illegitimate name *S. majeri* is a synonym of *S. bakonyensis*. A new name, *S. udvardyana*, is introduced here for the species occurring in the western Balaton region of Hungary, which was erroneously named "*S. bakonyensis*" in recent Hungarian literature.

Key words: apomictic taxa, Bakony Mts., Barabits, Jávorka, Lake Balaton, nomenclature, *Sorbus majeri*, taxonomy, typification

Introduction

The genus *Sorbus* (Linnaeus 1753: 477) s. l. (Rosaceae) embraces five sexual diploid species of different phylogenetic origin, each of them being currently classified in separate subgenera (Dickinson *et al.* 2007), with addition of diverse swarms of secondary hybrids between two or three primary types (Nelson-Jones *et al.* 2002). Polytopic origin of hybrid products between the same species, morphological heterogeneity of hybrids of the same origin and apomictic reproduction maintaining stability of these hybrids led to the recognition of narrowly defined segregates (clones or groups of closely related clones) as taxonomic species (Lepší *et al.* 2008, Rich *et al.* 2010). The taxonomy and nomenclature of *Sorbus* in Hungary still have many open questions. One of the disputable cases is *Sorbus bakonyensis*, whose place of valid publication, authorship, identity and distribution area are subject to radically different opinions. This apomictic species is endemic to Hungary and belongs to the *Sorbus latifolia* (Lamarck 1779: 486) Persoon (1806: 38) group, the most proliferous apomictic aggregate of *Sorbus* in Europe. This group originated from hybridization between *S. aria* (Linnaeus 1753: 475) Crantz (1763: 46) and *S. torminalis* (Linnaeus 1753: 476) Crantz (1763: 45) and is classified in the nothosubgenus *S.* subgen. *Tormaria* Májovský & Bernátová (2001: 21).

Material and Method

The collections of *Sorbus* preserved at the Hungarian Natural History Museum (BP) and at the Eötvös Loránd University (BPU) were examined for taxonomically relevant material and historical collections of Sándor Jávorka and other Hungarian dendrologists. The Hungarian literature on *Sorbus* was screened for protologues and further interpretations of the names available. References to the *International Code of Nomenclature for algae, fungi and plants* are provided according to its Melbourne edition (McNeill *et al.* 2012).

The valid publication of *Sorbus bakonyensis*

The first (and for a long time the only) taxon of the *Sorbus latifolia* group (presumably of hybridogenous origin between *S. aria* and *S. torminalis*) recognized in Hungary was *S. semiincisa* (Borbás 1879: 34) Borbás (1887: 403), originally described from the Buda Mountains. Subsequently its range was circumscribed as restricted to the mountainous region in the vicinity of Budapest, namely the Buda, Pilis, Visegrád and Gerecse Mountain ranges (Borbás 1882, Kárpáti 1960a).

In some earlier publications the region of Lake Balaton (Borbás 1900, Jávorka 1915, 1924–1925: 481) was also included in the distribution area of *S. semiincisa*. However, the latter locality was questioned by Boros (1924), who argued that the specimens collected in this region by himself (BP 299993, BP 432832, BP 432833, BP 432834, BP 689794) and formerly by Gáyér (BP 432775) were different from *S. semiincisa* and represented *S. latifolia* s. str. Consequently, the presence of *S. semiincisa* in the Balaton region was questioned by Jávorka (1924–1925: 1285) as well. In his further works, Jávorka (1927a, 1927b) did not consider Boros' and Gáyér's specimens as belonging to *S. latifolia* s. str. and described a new taxon, *S. franconica* Bornm. f. *bakonyensis* Jávorka (1927a: 87) to accommodate the *S. semiincisa*-like plants occurring in the Balaton region and also in Lower Austria, specifically at:

(1) Márkó in the eastern Bakony Mountains, on the basis of the aforementioned specimens of Boros, published in Boros (1924);

(2) the vicinity of Keszthely, Lesenceistvánd and Sümeg in the western part of the Balaton region, vouchered by specimens of Borbás, Gáyér and Jávorka;

(3) Hainburg in Lower Austria, vouchered by specimens of Gáyér, published in Gáyér (1917).

Besides, some Slovak localities were also mentioned in the protologue of *S. franconica* f. *bakonyensis*. Since Jávorka (1927a) considered the Slovak plants more or less intermediate between the forma *bakonyensis* and *S. austriaca* (Beck 1892: 713) Prain (1908: 168), they are of secondary relevance here.

It is noteworthy that recently (e.g. Suck & Meyer 1990, Kutzelnigg 1995, Jakubowsky & Gutermann 1996, Kovanda 1996, Kurtto 2009) the name *S. franconica* was ascribed to Düll (1961: 49), who attempted to validate Bornmüller's name because it was thought to be invalidly published by Bornmüller (as *nomen nudum*). Nevertheless, Bornmüller (1918: 186) provided a brief German diagnosis of this new hybrid (“meist kleinere Blätter mit stärkerem Filz und mit mehr abgerundeter Spitze”) that is minimalistically sufficient to reflect the implied difference from the similar *S. aria* subsp. *graeca* (Spach 1834: 102) Nyman (1889: 118) (= *S. graeca* (Spach) Schauer (1848: 292)). One may doubt if Bornmüller, who treated *S. franconica* as a separate hybridogenous taxon, had definitely accepted it at the rank of species, because his ranking criteria were rather unclear (see his footnote on page 186, where Bornmüller declared that ranking of segregate taxa within a “Linnaean” species is a matter of taste). Bornmüller treated the species of *Sorbus* broadly, in the “Linnaean” sense, but some of his “races”, including *S. franconica*, were consistently ranked as species and should be accepted as such. These doubts notwithstanding, Jávorka (1927a) definitely accepted Bornmüller's species name, providing a full and direct reference to the place of its original description, and by doing so he fulfilled the conditions of valid publication again. Important to our study, the name *S. franconica* f. *bakonyensis* was consequently validly published in 1927.

One year later *S. franconica* f. *bakonyensis* was raised to the rank of species by Jávorka (1928: 284), supplied with a short Hungarian diagnosis distinguishing it from *S. semiincisa* and *S. degenii* Jávorka (1927a: 85). Because of the semipopular nature of that publication (the article appeared in a horticultural periodical), Jávorka made no ascription of the new species name and no reference (even cryptic) to the presumed basionym, but the name was validly published as a new combination under Art. 41.4. The identity of *S. bakonyensis* and *S. franconica* f. *bakonyensis* is evident not only from the adopted epithet and diagnostic characters, but also from the indication of the first collector (Borbás) and the distribution area of this taxon. The authorship “(Jáv.) em. Kárpáti comb. nova” that appeared in Kárpáti (1949: 116) is an attempt to create an isonym, and the ascription of this combination to Kárpáti, as used in recent Hungarian literature (Barabits 2007, Németh 2009, 2010, 2012, 2013), is incorrect. In later works of Jávorka (Jávorka & Csapody 1929–1934, Jávorka 1937, Jávorka & Soó 1951) *S. bakonyensis* was consistently treated at the rank of species.

The early taxonomic history of *Sorbus bakonyensis*

Jávorka and contemporary botanists applied the name *S. bakonyensis* to a species complex that was subsequently split into numerous taxa. After the original description the distribution area of *S. bakonyensis* was even more expanded (Jávorka 1937). Following the reports of *S. latifolia* (Boros 1933) and *S. bakonyensis* (Boros 1937) from the Vértes Mountains, “Vértes” as a locality for *S. bakonyensis* appeared in Jávorka (1937). These records were subsequently reassigned to newly described taxa, *S. pseudolatifolia* Boros (1937: 51) and *S. pseudobakonyensis* Kárpáti (1949: 117), respectively. Similarly, the record of *S. bakonyensis* from the Burok Valley (Bakony Mountains), added in Jávorka (1930) and cited by Boros (1937), was subsequently referred to *S. redliana* Kárpáti (1949: 118).

Further revisions that drastically changed the circumscription of *S. bakonyensis* were carried out by Kárpáti (1949, 1950, 1960a). These changes affected all the localities included in the original concept of *S. bakonyensis* apart from Márkó (the original locality 1), as described below. Kárpáti (1949: 121) excluded some specimens (BP 432501, BP 702614, BP 702620, BP 702621, BP 702598, BP 702599) collected in the Keszthely Mountains and partly distributed as *S. franconica* f. *bakonyensis* by Jávorka (1927b), in favour of the new *S. balatonica* Kárpáti (part of the original locality 2). Kárpáti (1950: 35) excluded some specimens collected by Gáyér at Sümeg (BP 702577), and by Jávorka at Lesenceistvánd (not found) and in the Keszthely Mountains (BP 112253, BP 702578, BP 702576) in favour of his new *S. gayeriana* Kárpáti (part of the original locality 2). The specimens (BP 236726, BP 236727, BP 236731) collected by Gáyér at Mount Hundsheimer at Hainburg (Austria), published in Gáyér (1917) and cited by Jávorka (1927a), were also excluded from the concept of *S. bakonyensis* and revised as *S. × franconica* (Kárpáti 1949, 1960a: 299) (the original locality 3). These specimens probably belong to *S. slovenica* Kovanda (1961: 73) (see Jakubowsky & Gutermann 1996, Németh 2010).

After his emendations Kárpáti (1949, 1950, 1960a) restricted the area of *S. bakonyensis* s. str. to two phytogeographical regions of Hungary (Kárpáti 1960b) corresponding to the locality 1 (that belongs to *Vesprimense*) and part of the locality 2 (that belongs to *Balaticum*) listed above.

The typification of *Sorbus bakonyensis*

Jávorka and Kárpáti did not use the type concept. Although Kárpáti restricted the application of the name *S. bakonyensis*, he had not typified it. Kárpáti (1949: 115, 1950: 32) only suggested to maintain this name for the morphotype illustrated in Jávorka (1927a: 86, figure “B”; silhouette of a single leaf), since he found this leaf shape to be the most frequent among herbarium specimens collected in the Balaton region (including Márkó in the Bakony Mountains). Nevertheless, the voucher specimen for figure “B” remained unknown to Kárpáti.

As evident from a pencil note on the herbarium sheet, the leaf silhouette in Jávorka (1927a) was taken from Jávorka’s specimen (BP 702610) collected in a pine plantation at Gyenesdiás village (Keszthely Mountains) in May, 1926. This early collected specimen, lacking any revision or note by Kárpáti, consists of two branches mounted on a single sheet. The upper one was collected after flowering, and the lower one, to which the pictured leaf belongs, is sterile. They were identified by Németh (2010: 380) as *S. balatonica* and *S. bakonyensis*, respectively.

The lectotypification of the name *S. bakonyensis* was effected much later by Kováts (1998), who selected a specimen (BP 299993) collected by Boros at “Kápolnadomb” near Márkó village on 8 October 1920 and originally identified as “*S. latifolia* Lam.” (Boros 1924). This specimen is part of the original material (locality 1) as discussed above.

Further disentangling of *Sorbus bakonyensis*

Recently Barabits (2007) reached to the conclusion that the populations of *S. bakonyensis* of *Vesprimense* and those of *Balaticum* (Kárpáti 1960b) are taxonomically different. He decided to describe the plants from the vicinity of Márkó (eastern Bakony Mountains, *Vesprimense*) as a new species, *S. majeri* Barabits (2007: 14). Barabits designated an isolectotype of *S. bakonyensis* as the holotype of his new species name and cited the lectotype among the specimens examined. By doing so he created a superfluous name for *S. bakonyensis* (Art. 52.1) and left the other species (*S. bakonyensis* sensu Barabits) nameless.

Barabits (2007) decided that the name *S. bakonyensis* should be retained for the plants of the *Balatonicum* because he believed that the illustration in Jávorka (1927a: 86, figure “B”) matched these plants and was, in his opinion, decisive in the correct application of this name. For the same reason Németh (2010) decided that the lectotype designated by Kováts (1998) may be superseded. The new lectotype designated by Németh (2010) was selected from the original collections of Gáyér, although the leaves on the new lectotype (BP 702615) and isolectotype (BP 702616) are evidently different from those of Jávorka’s specimen (BP 702610).

As noted above, Jávorka (1927a, 1928) applied the name *S. bakonyensis* to a species complex, and in the absence of holotype or syntype indication no kind of posterior “priority” can be given to any element of the original material (Art. 9.12). The identity of that particular leaf, which silhouette was reproduced by Jávorka (figure “B”), can hardly be indicative of the typical element of the taxon, because at the same time Jávorka referred to the picture of *S. semiincisa* in Borbás (1900: 208) that he considered a good representative of his *S. bakonyensis* (this picture considerably differs from figure “B” and may represent *S. semiincisa*). Since Kováts (1998) selected an original element that was included in his contemporary concept of *S. bakonyensis*, and before Barabits (2007) nobody (neither Jávorka, nor Kárpáti) questioned the taxonomic identity of the populations of *Balatonicum* and *Vesprimense*, Németh (2010) incorrectly claimed that Kováts “ignored the species concept of *S. bakonyensis* of earlier and contemporary botanists”.

Moreover, Jávorka’s note on the widespread occurrence of his *S. bakonyensis* in the Keszthely Mountains, also adduced by Németh (2010) in favour of his retypification, refers to the locally common (but only subsequently described) *S. balatonica*, and not to *S. bakonyensis* sensu Németh that otherwise seems to be a rather rare taxon in the Keszthely Mountains. This assumption is confirmed by the following facts:

(1) Jávorka’s (1927a) note about the widespread occurrence of his *S. bakonyensis* in the vicinity of Keszthely town is in agreement with the label of his early collection (BP 702620, BP 702621) from this area, reading “in dumetis collium dolomiticorum abunde”; this specimen represents *S. balatonica*;

(2) the text on the printed label of Jávorka’s *Flora Hungarica exsiccata* VIII: No. 751 (Jávorka 1927b), which framed the future concept of *S. balatonica*, reads “forma haec praecipue in montibus dolomiticis circa opp. Tapolca, Sümeg et Keszthely valde frequens occurit”;

(3) the picture of Jávorka’s *S. bakonyensis* in his *Iconographia* (Jávorka & Csapody 1929–1934: 235, fig. 1729a) represents *S. balatonica*.

The lectotype designated by Kováts is selected in accordance with the requirements of Art. 9.12, is not in serious conflict with the protologue (Art. 9.19), and therefore may not be superseded on any other ground. *Sorbus majeri* is to be considered a synonym of *S. bakonyensis*, the distribution area of which is restricted to the vicinity of Márkó village in the eastern Bakony Mountains. The other taxon (i.e. *S. bakonyensis* sensu Barabits and Németh) that occurs mainly in the western part of the Balaton Uplands and the southwestern part of the Bakony Mountains, as well as in the eastern part of the Keszthely Mountains is described here as a new species, *S. udvardyana* Somlyay & Sennikov. Since *S. udvardyana* is somewhat morphologically variable throughout its distribution range, further investigations are required to correctly judge the proper taxonomic rank of its different forms. For this reason we give the species’ description below exclusively based on the specimens from the locus classicus (Tóti-hegy).

Sorbus udvardyana Somlyay & Sennikov *sp. nov.* (Fig. 1)

A Sorbo bakonyensi foliis crassioribus, rhombiformi-ovatis vel ovatis (non late ellipticis vel elliptico-ovatis), fructibus sanguineis (non brunneo-rubris), a Sorbo balatonica foliis rhombiformi-ovatis vel ovatis (non elliptico-ovatis vel orbiculari-ovatis), ab utraque foliis plerumque minoribus et praecipue subtus viridi-griseis (non cinereo-albidis) differt.

Type:—HUNGARY. Balaton Uplands, Káptalantóti: Tóti-hegy, 46°50’09.45” N, 17°31’15.81” E, 16 September 2011, *Somlyay & Bauer s.n.* (holotype BP 711382, isotype BP 711383) (Figs. 2, 3).

Shrubs or small trees. Bark grey; twigs brownish grey; young shoots brown, with numerous whitish lenticels. Buds ovoid, ± acute, 6–10 × 3–4 mm; bud scales olive green with narrow red-brown, sparsely tomentose margins. Leaves simple, relatively rigid, dark green and glabrous above, greenish-grey tomentose beneath (remarkably greener in colour than in *S. balatonica* and *S. bakonyensis*); petioles (10–)15–20(–25) mm long; leaf blades on short fertile shoots 6–9 × 5–7.5 cm, rhombic-ovate to ovate, widest below the middle of lamina length, apex triangular with convex sides, base rotund to narrowly rotund, sides serrate (apically) to explicitly shallowly lobed



FIGURE 1. Photograph of fruiting branch from the type tree of *Sorbus udvardyana*.—Tóti-hegy, 16 September 2011.—Photo by N. Bauer.

(basally up to c. 1/6 width of half-lamina); veins 9–11 on each side; prominent lobes 3–5 on each side, apex \pm blunt to acute or acuminate, margins convex to conspicuously convex and obscurely serrate; approximate length of the upper side of the greatest lobe 4–7 mm long; leaf blades on short sterile shoots rhombic or elliptic or ovate, cuneate or broadly cuneate at base. Inflorescence compact, corymbose, branchlets tomentose. Flowers 10–14 mm in diam.; hypanthium turbinate; sepals triangular, densely tomentose on both surfaces, apex acuminate; petals white, elliptic to broadly elliptic, 4.5–6 \times 3.5–4.5 mm; stamens c. 20; filaments whitish; anthers yellow; styles 2. Fruits subglobose or globose, 10–13 mm in diam., sanguineous when fully ripe (without a tint of orange or brown colour), with numerous small lenticels. Seeds not observed. Flowering in May.

Etymology:—The specific epithet commemorates the Hungarian botanist, László Udvardy (1968–2010), who investigated chorology, cultivation and invasion ecology of Hungarian arboreal flora.

Distribution and habitat:—Endemic to Hungary, restricted to the Transdanubian Mountains: western part of the Balaton Uplands, western part of the Bakony Mountains, eastern part of the Keszthely Mountains (Fig. 4). Grows mostly in open, isolated localities, mainly on cliffs or in upper parts of gravelly slopes. Our distribution map is based on the examined specimens kept at BP and BPU, which represent all known localities of the species; more detailed map based on extensive field studies and private collections is published in Németh (2013: 93) under “*Sorbus bakonyensis*”.

Conservation status:—*Sorbus udvardyana* (recorded as “*S. bakonyensis*”) is assessed as threatened and legally protected in Hungary, together with all other hybridogenous derivatives of *S. aria* [100/2012. (IX.28.) VM ministerial decree]. Estimated IUCN conservation status (IUCN 2001): Vulnerable (criteria C2a(i)).



FIGURE 2. Holotype of *Sorbus udvardyana*, showing the leaves on fertile shoots.



FIGURE 3. Isotype of *Sorbus udvardyana*, showing the leaves on sterile shoots.

Additional specimens examined (paratypes):—HUNGARY. Balaton Uplands: Badacsonytomaj: Badacsony, “Kökapu”, 20 June 1952, *Kárpáti* (BP 701346!, ? BP 701347!, BP 701348!, BP 701349!); loc. cit., 13 September, 2012, *Somlyay & Bauer* (BP 728604!, BP 728605!); Badacsonytördemic: Badacsony, “Rodostó”, 20 June 1952, *Kárpáti* (BP 701350!); Badacsonytördemic: Badacsony, “Közsákok”, 8 August 1952, *Papp* (BP 373823!); s. loc.: Badacsony, 25 August 1952, *Papp* (BP 373822!); Gyulakeszi—Tapolca: Csobánc, 1 May 1959, *Boros* (BP 448751!); loc. cit., 16 September 2010, *Somlyay & Bauer* (BP 710665!); loc. cit., 27 July 2013, *Somlyay* (BP 728844!, BP 728845!, BP 728846!, BP 728847!, BP 728848!, BP 728849!, BP 728850!); Hegymagas – Kisapáti – Tapolca: Szent György-hegy, 19 May 1949, *Boros* (BP 432308!); loc. cit., 19 May 1949, *Károlyi* (BP 299479!); loc. cit., 30 September 1950, *Kárpáti* (BP 432782!, BP 701353!, BP 701354!); loc. cit., 30 September 1950, *Priszter* (BP 692560!, BP 692561!, BP 692562!, BPU 16577!); loc. cit., 25 July 2013, *Somlyay* (BP 728851!, BP 728852!, BP 728853!, BP 728854!, BP 728855!, BP 728856!, BP 728857!, BP 728858!, BP 728859!); Káptalantóti: Tóti-hegy, 2 August 1938, *Jávorka* (BP 702607!); Zalahaláp: Haláp, 11 August 2012, *Bauer* (BP 727526!, BP 727527! except the right lowermost fragment which belongs to *S. danubialis*); loc. cit., 23 August 2013, *Somlyay & Bauer* (BP 728860!, BP 728861!, BP 728862!, BP 728863!).—Bakony Mts.: Sáska: Magyal-hegy, 13 August 2012, *Bauer* (BP 727524!, BP 727525!); loc. cit., 23 August 2013, *Somlyay & Bauer* (BP 728868!, BP 728869!, BP 728870!, BP 728871!, BP 728872!, BP 728873!, BP 728874!, BP 728875!); Sümeg – Tapolca: “Úrbéri-erdő”, 29 August 1926, *Gáyer* (BP 702615!, BP 702616!); loc. cit., 5 September 1926, *Gáyer* (BP 702618!); loc. cit., “Uzsapuszta”, 16 May 1950, *Stieber* (BP 601350!); loc. cit., “Uzsa”, 7 June 1950, *Boros* (BP 432898!); loc. cit., “Tompör Cser”, 16 September 2011, *Somlyay & Bauer* (BP 711385!); Zalahaláp–Ódörög: Csilla-hegy, 26 August 1927, *Jávorka* (BP 702619!); loc. cit., 16 September 2011, *Somlyay & Bauer* (BP 711384!).—Keszthely Mts. Balatonyörök: Bodorhálás, 18 September 1949, *Kárpáti* (BP 432790!); loc. cit., 18 September 1949, *Pénzes* (BP 366616!); loc. cit., 18 September 1949, *Priszter* (BP 692567!, BP 692568!, BPU 16578!); loc. cit., 18 September 1949, *Vajda* (BP 214301!); Balatonyörök: Felső-hegy, 18 September 1949, *Pénzes* (BP 366614!); Balatonyörök: Fertős-tó-hegy, 22 August 2013, *Somlyay & Bauer* (BP 728864!, BP 728865!); Balatonyörök: Garga-hegy, 18 September 1949, *Kárpáti* (BP 432789!); loc. cit., 29 September 1950, *Kárpáti* (BP 432399!); Balatonyörök: Kerek-hegy, 22 August 2013, *Somlyay & Bauer* (BP 728866!, BP 728867!); Balatonyörök: Madaras-tető, 29 September, 1950, *Kárpáti* (BP 702609!); loc. cit., 15 September 2010, *Somlyay & Bauer* (BP 710654!, BP 710655!); Balatonyörök: Szoba-kő, 15 September 2011, *Somlyay & Bauer* (BP 711380!, BP 711381!).

Comparison of main diagnostic characters of species in the *Sorbus bakonyensis* complex (leaves on fertile shoots, and ripe fruits)

Character/species	<i>Sorbus andreanszkyana</i>	<i>Sorbus bakonyensis</i>	<i>Sorbus balatonica</i>	<i>Sorbus gayeriana</i>	<i>Sorbus udvardyana</i>
Leaf shape	acuminate ovate	broadly elliptic to elliptic-ovate	elliptic-ovate to orbicular-ovate	triangular-ovate	rhombic-ovate to ovate
Leaf apex (upper third of the blade)	attenuate triangular with straight sides	triangular with convex sides	triangular with convex sides	broadly triangular with convex sides	triangular with convex sides
Leaf base (lower part of the blade)	broadly rotund to broadly cuneate	broadly cuneate	rotund	broadly truncate to cordate	rotund or narrowly rotund
Leaf lobes, with approximate length of the upper side of the greatest lobe (mm)	sharply triangular with straight sides, 4–10	(blunt) triangular with convex sides, 5–7	blunt triangular with convex sides, 3–6	broadly triangular with conspicuously convex sides, 6–10	(blunt) triangular with (conspicuously) convex sides, 4–7
Number of lateral veins	11–15	8–10	9–10	8–9	9–11
Leaf size (cm)	8–13 × 6–11	7–11 × 6–9	6–10 × 6–9	6–10 × 7–10	6–9 × 5–7.5
Tomentum on lower leaf surface	whitish-grey	whitish-grey	whitish-grey	yellowish- to greenish-grey	greenish-grey
Leaf texture	rigid	relatively thin	rigid	rigid	relatively rigid
Fruit colour	red with only a few lenticels	brownish red with sparse lenticels	bright red with numerous lenticels	reddish brown with numerous lenticels	sanguineous with numerous lenticels

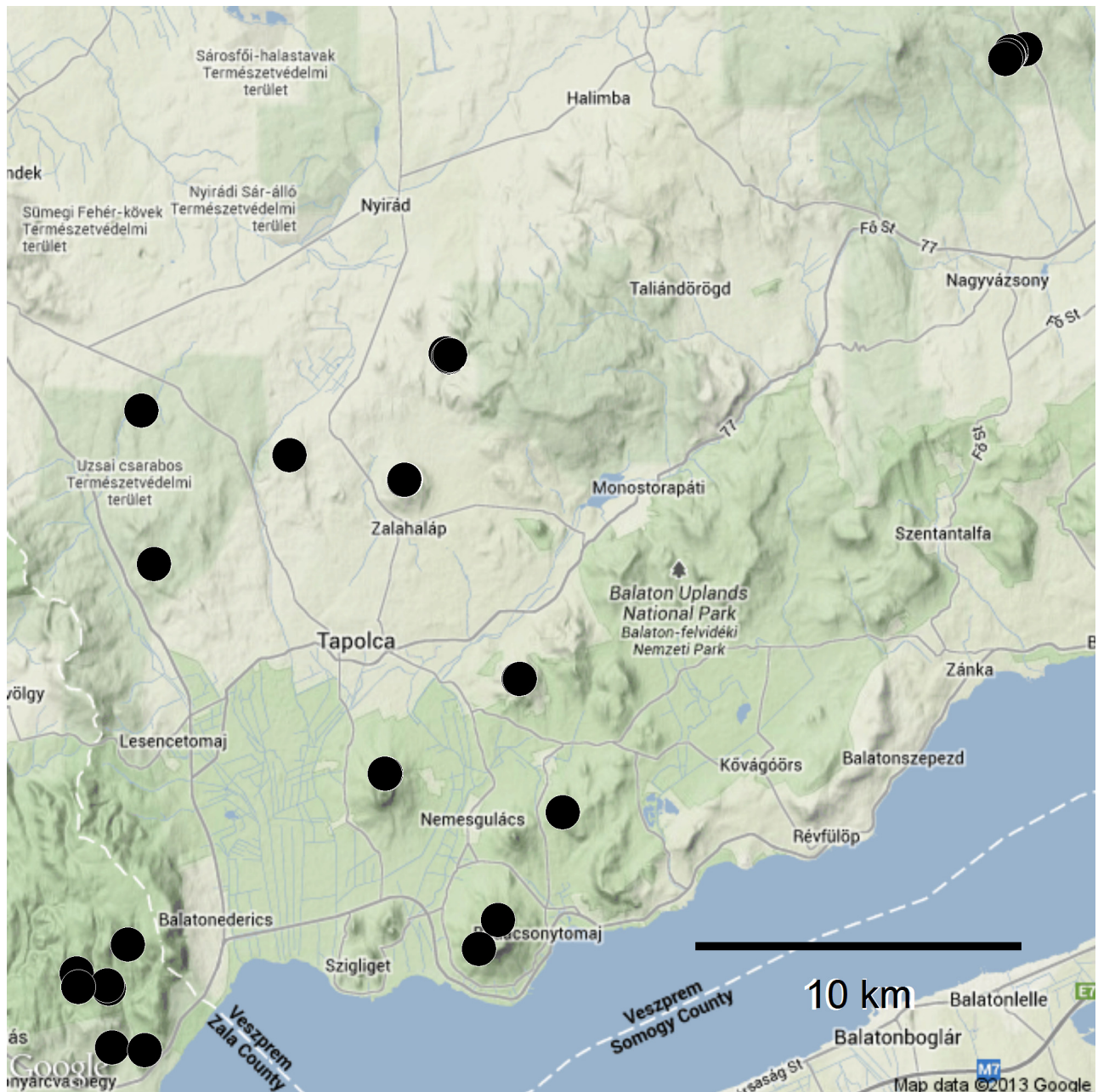


FIGURE 4. Distribution area of *Sorbus udvardyana*.

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