

***Melica altissima* in Slovakia, vanishing grass species of forest ecotones**

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Eliáš P. jun., Dítě D., Dítě Z. & Eliašová M. (2017): *Melica altissima* in Slovakia, vanishing grass species of forest ecotones. – Thaiszia – J. Bot. 27 (2): 117-128. – ISSN 1210-0420.

Abstract: Historical and current occurrence of perennial grass *Melica altissima* was studied in Slovakia during 2011–2017. The species occurrence was scarce in five phytogeographical districts studied (the Podunajská nížina, Ipeľsko-rimavská brázda region, Malé Karpaty Mts., Považský Inovec Mts., Spišská kotlina Basin); we recorded 11 native localities in total, including historical and current sites, as well. The number of localities decreased markedly and we documented only two sites during our field research. Therefore, *Melica altissima* belongs to the critically endangered plants of Slovak flora. Ecological and phytosociological data of *M. altissima* habitats are also presented.

Keywords: Central Europe, distribution, ecology, endangered species, habitats, Poaceae.

Introduction

Melica altissima (syn. *Melica altissima* var. *atropurpurea* Papp; *M. altissima* var. *interrupta* Reichenbach; *M. sibirica* Lam.) is a robust perennial grass species of subgenus *Altimelica* Hempel 1973 which contains elements of Euro-Asiatic forest-steppes and of South American dry tropical forests. Within this subgenus, *M. altissima* is included in the section *Altimelica* Hempel 1973 covering only three

Eurasian taxa. Except above mentioned taxon, *Melica tibetica* Rosh. and *Melica tangutorum* Tzvelev are included here (HEMPEL 1973). The disjunctive distribution range of a continental species *M. altissima* ranges from Central Europe (Austria, Hungary, Slovakia), the Balkans (former Yugoslavia, Bulgaria, Romania) and southern part of the Eastern Europe (Ukraine, Russia) to Asia Minor (Turkey), Southwestern (Caucasus, N Iran), Central (S Siberia, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan) and Eastern Asia (China) (STANKOV & TALIEV 1949; CONERT 1998; HOLUB & MICHALKO 1999; ZHENLAN & PHILLIPS 2006).

At its north-western limit of the distribution range in Central Europe, *Melica altissima* is quite rare. The species is evaluated as critically endangered in Austria (NIKLFELD & SCHRATT-EHRENDORFER 1999) where it is occupying only single native locality (FISCHER et al. 2005), it is regarded as critically endangered also in Slovakia (ELIÁŠ et al. 2015) where only three recent localities were published (HOLUB & MICHALKO 1999). The species is not considered rare nor endangered in Hungary (KIRÁLY 2007), however, it is evaluated in category Near threatened (NT) in „Dél-Tiszántúl” Region (SE Hungary) (SALLAINÉ KAPOCSI et al. 2012).

Melica altissima is a grass species with relatively considerable potential for human use (GOŁIŃSKA et al. 2003). It is popular ornamental plant (CONERT 1998; ZHENLAN & PHILLIPS 2006), it is recommended as a good forage (HOLUB & MICHALKO 1999) and potential grass species for reclamation (MAJTKOWSKI & MAJTKOWSKA 1998).

The occurrence and coenological affinity of *Melica altissima* has not been studied recently in Slovakia. Since 2011, we attempted to verify several sites, with unsatisfactory success. For this reason, we have undertaken to process the distribution, ecology and coenology of this species in more detail including field research and study of herbarium material. The results of this work are presented in this paper.

Material and methods

The field study was carried out during the years 2011–2017. Data concerning the distribution of the species was obtained from herbaria BP, BRA, BRNM, BRNU, KO, LTM, NI, OL, OLM, PMK, PR, PRC, SAV, SLO and ZV. Herbarium acronyms are according to THIERS (2017) and VOZÁROVÁ & SUTORÝ (2001), respectively.

The grid distribution map was created according to the methodology published by NIKLFELD (1971). The map was designed by program ArcGis, version 9.2 using the data from herbarium specimens, literature sources and field research. Localities confirmed during the study are considered recent, all others are considered historical.

Nomenclature of flowering plants follows MARHOLD & HINDÁK (1998). Names of syntaxa are according to JAROLÍMEK et al. (2008), if the syntaxon is not published in this work, we include it with the authors' abbreviations and the year of description. Phytogeographical divisions of FUTÁK (1980) are also used.

List of localities (Appendix 1) is processed according to the rules of Flóra Slovenska project (GOLIAŠOVÁ & MICHALKOVÁ 2016). Both data from herbarium specimens and literature sources are included together and localities within particular districts are listed in direction from west to east. Names of municipalities are according to the work of MAJTÁN (1972). If names of settlements given by authors are different to above work in the list of localities, we enclosed original names in square brackets.

Phytosociological relevés were sampled according to the Zürich-Montpellier approach using the adapted nine-grade Braun-Blanquet's scale (WESTHOFF & VAN DER MAAREL 1978). Moss layer (E_0) was not established.

Results and discussion

Distribution in Slovakia

During our study, we found 11 native localities of *Melica altissima* in Slovakia and two localities of the cultural origin (cultivation in botanical garden and escaping from private garden). Distribution of the species is very scattered and two small distribution centres were found: a) four sites in a broader surrounding of the Smolenice settlement in the Malé Karpaty Mts., the Carpathicum district, and b) four sites in the area between Šahy and Plášťovce in the Pannonicum district. Other three localities represented more or less isolated populations (Fig. 1). Recent occurrence was confirmed only at two nearby localities in Southern Slovakia (Dolné Semerovce, Plášťovce), although we have visited most of the other sites repeatedly (e.g. Ostrý Kameň site in 2011, 2012, 2014 and 2016).

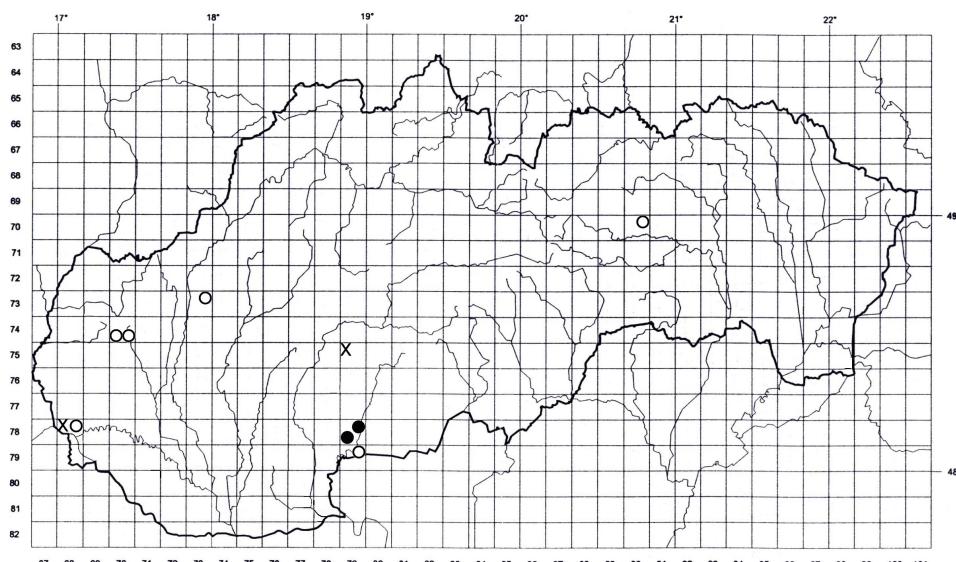


Fig. 1. Distribution of *Melica altissima* in Slovakia: ○ – historical localities, ● – recently confirmed localities, X – cultivation or escaping from cultivation.

Near the Dolné Semerovce settlement, the species creates two relatively large micropopulations including dozen of individuals. The first one, closer to the village, is situated in forest ecotone along the road No. 75 in about 220 m in length. The second micropopulation is smaller; it is located in shrub vegetation at the edge of the road to Vyškovce nad Ipľom in about 150 m in length and circa 300 m SE from the first one. The second recent locality is located ca 800 m W–WNW from the Plášťovce settlement. A large number of *M. altissima* individuals occupy edges of narrow road through the gardening settlement (gardens, vineyards and wine cellars), forest edges and adjacent areas at about 700 m in length. KoŠŤAL (2008) regarded this locality as probably secondary due to the character of the site, however, DOČOLOMANSKÝ (1958 BRA) had no doubt about originality of *M. altissima* occurrence near Plášťovce in his herbarium voucher (e.g. escaping from the culture, habitat of anthropogenic origin). The occurrence of the species there can be considered as original especially with respect to the absence of recent cultivation in the Plášťovce village (our field research) and the existence close uniquely original (perhaps parental?) site near Dolné Semerovce.

Eight of the localities are regarded historical because we confirmed the species not there. Two of them were destroyed due human construction activity in the past (Bratislava, Šahy), their natural origin is under doubt (HOLUB & MICHALKO 1999). Today it is difficult to decide whether these sites were original. However, in favour of this theory, *M. altissima* has grown on the edge of vineyards in steppe vegetation according to both authors of the data (PANTOCSEK 1907; ŠVEC 1947 LTM).

The reasons of the rapid disappearance of other – uniquely native localities (the Malé Karpaty Mts., the Považský Inovec Mts. and the Spišská kotlina Basin) are not clear because we have not noticed any large-scale significant negative changes in the status of habitats – all those sites are included in the net of protected areas (HOLUB & MICHALKO I. c.). The negative influence of herbivores was not recorded which is probably related to content of poisonous cyanogenic glycosides (CONN 1981). In the same way, the disruptive effect of disturbances by animals (wild boar – *Sus scrofa*) to *M. altissima* population has not been clearly demonstrated (SCHMITZBERGER et al. 2010). We assume that there could be successive changes involving the expansion of the shrubs (e.g. *Cornus mas*, *Ligustrum vulgare*, *Prunus spinosa*, *Swida sanguinea*) and the deterioration of the light conditions at the site. According to HOLUB & MICHALKO (I. c.) the populations in Ostrý Kameň, Bezovec and Dreveník were restricted and not numerous; therefore also small changes of habitat quality could be fatal for them. Other fact is also interesting – HOLUB & MICHALKO (1999) mentioned those above indicated sites as recent, although they are not confirmed by recent herbarium vouchers (from these authors or other collectors). While the last herbarium collections from these sites come from a relatively long period to the past – the Ostrý Kameň site from 1960s (SKŘIVÁNEK 1964 BRNM), the Bezovec hill from the 1970s (NEVRLÝ 1972 BRA, BRNU, PR) and the Dreveník area even to up from the 1930s and 1940s (GRESCHIK 1934, 1942 SLO). It is interesting that this last herbarium vouchers from Dreveník site represents only plants from Slovakia

with red inflorescences called *M. altissima* ‘Atropurpurea’ which are often cultivated for ornamental purposes (CONERT 1998; GREEN 2009). However, GRESCHIK has not explained anything more about the origin of these collections. Only that is certain that the research activities carried out more recent, for example ŠMARDA (1961) did not confirm *M. altissima* even during the detailed study of vegetation in the Spišská kotlina basin. Similarly, several authors (e.g. JURKO & KONTRIŠ 1982; GALGÓCI & ŠTRBA 2008; GALGÓCI et al. 2009; BAŽÁNY et al. 2016) did not find it in the Záruby Nature Reserve (the reserve includes also the Ostrý Kameň site, the Čelo hill and the Veterlín hill) as well as DOMINOVÁ (2008) in the Bezovec hill. In view of the above mentioned information, the inclusion of *M. altissima* in the Slovak Red List in the IUCN category CR – critically endangered (ELIÁŠ et al. 2015) is fully justified during our study.

Before our research, distribution data of *Melica altissima* were scarce in Slovakia; it has varied from two (DOSTÁL 1948-1950, 1958) to four (DOSTÁL & ČERVENKA 1992) and five localities (HOLUB & MICHALKO 1999), respectively. One of the first data from eastern part of Central Europe published HERBICH (1834) from the Pieniny region, Slovak-Polish border area. He mentioned the locality as “st. Kunigunda Berg”, now the Zamczysko Hill in Poland not far from Slovakia (KNAPP 1872; FILARZSKY 1898; MIREK & PIĘKOŚ-MIRKOWA 2008). First data from the territory of present Slovakia was given by KALCHBRENNER (1853) in second half of 19. century. He found *M. altissima* in the rocky vegetation of the Dreveník area near the Spišské Vlachy settlement. More than a half century later, the species was recorded at Bratislava (PANTOCSEK 1907) and the Ostrý Kameň site in the Malé Karpaty Mts. (SILLINGER 1926 BRNU, PR, PRC). The other sites were discovered already after the WWII (Šahy – ŠVEC 1947 LTM) or, respectively, in the 1950s (Plášťovce – DOČOLOMANSKÝ 1958 BRA; Bezovec – MICHALKO 1959 SAV) and 1960s (Dolné Semerovce – KOPECKÝ 1963 PR). Taking into account this situation, it is not excluded that several other sites of *M. altissima* may appear above the borders of Hungary in the future, especially in SE Slovakia, because quite a lot new sites have been found recently in NE Hungary relatively close to Slovakia (MOLNÁR & TÜRKE 2007; MOLNÁR 2014; BARTHA et al. 2015; MOLNÁR et al. 2016). It is also known that the species has occurred along the roadside and railway edges and borderlines in SE and NE Hungary (CSATHÓ 2008; SCHMOTZER 2014).

Melica altissima is cultivated as ornamental plant and it is escaping from the culture relatively frequently (CONERT 1998). At least two Slovak localities have been of this origin. SZÉP (1915 BRA, NI) collected it in botanical garden in Bratislava and DEYL (1968 OLM) found it escaping from the culture in shrubs in the urban area of the Banská Štiavnica settlement. Secondary occurrence or spreading as alien is known also from many countries of Europe: Austria (HOHLA 2003; FISCHER et al. 2005), the British Isles (GREEN 2009), the Czech Republic (DOSTÁL & ČERVENKA 1992; DANIHELKA & ŘEPKA 1995), Germany (CONERT 1998), Lithuania (GUDŽINSKAS 2017), Norway (GEDERAAS et al. 2012), and Poland (GŁAZEK 1997; TOKARSKA-GUZIK et al. 2012). According to BARKWORTH (2007) it was introduced to the North America (Ontario, Oklahoma and New York).

Ecology and coenology

Analysing of several data from herbarium labels, published information and field research, *Melica altissima* has been predominantly a species of forest ecotones in Slovakia. Only smaller parts of localities represent more or less open xerothermic habitats (Bratislava, Šahy). The species preferred especially slightly shaded areas but it can also survive in sunny locations. Thus, our data correspond to the published knowledge describing *M. altissima* as species of woodland fringes, scrub habitats, meadows and slopes (TUTIN 1980; CONERT 1998; ZHENLAN & PHILLIPS 2006).

Recently confirmed Slovak localities are characterized by relatively dense stands of herb layer where only vegetative reproduction by underground sprouts (GUDŽINSKAS 2017) allows surviving of *Melica altissima* individuals. Finally, it showed our phytosociological relevés 1–3 mentioned below.

Relevé 1 represents former stand of the alliance *Aceri tatarici-Quercion* from the class *Quercetea pubescenti-petraeae* (relatively well preserved stand of this alliance are present in upper part of this locality) where degradation process has advanced significantly due invasion of *Robinia pseudoacacia*. From this reason, many nitrophytes are present in herb layer (*Ballota nigra*, *Chelidonium majus*, *Chenopodium album*, *Urtica dioica*). The succession process leads to development of vegetation to the alliance *Chelidonio-Robinion*.

Relevé 1: Dolné Semerovce, forest edge near road No. 75, relevé plot size 100 m², exposition NE, elevation 5°, E_{tot} 75%, E₁ 60%, E₂ 30%, E₃ 30%, 158 m a.s.l., N 48°6'56.07", E 18°52'10.11", 26. 6. 2012, P. Eliáš jun.

E₃: *Robinia pseudoacacia* 2b, *Quercus petraea* agg. 1, *Tilia cordata* 1.

E₂: *Sambucus nigra* 2b, *Euonymus europaeus* 1.

E₁: *Melica altissima* 3, *Urtica dioica* 2a, *Artemisia vulgaris* 1, *Galeopsis pubescens* 1, *Galium aparine* 1, *Geranium robertianum* 1, *Chaerophyllum bulbosum* 1, *Chenopodium album* 1, *Arctium tomentosum* +, *Ballota nigra* +, *Chelidonium majus* +.

The stand of relevé 2 reflects vegetation of the association *Ligstro-Prunetum*, alliance *Berberidion vulgaris*, and class *Rhamno-Prunetea*. It was created probably after the vineyard abandonment when first *Melica altissima* began spreading from the nearby forest edges and later the bushes gradually occupying the area. However, presence of *Robinia pseudoacacia* in tree layer clearly indicates that the ultimate succession stage will be, as in previous case, a forest vegetation of *Chelidonio-Robinion*.

Relevé 2: Dolné Semerovce, the clearing (abandoned vineyard) in *Robinia pseudoacacia* stand above the road to Vyškovce nad Ipľom, relevé plot size 80 m², exposition SE, elevation 5°, E_{tot} 80%, E₁ 60%, E₂ 20%, E₃ 5%, 135 m a.s.l., N 48°6'44.07", E 18°52'20.90", 26. 6. 2012, P. Eliáš jun.

E₃: *Robinia pseudoacacia* 1, *Juglans regia* +.

E₂: *Prunus spinosa* 2b, *Euonymus europaeus* 1, *Lycium barbarum* 1, *Rosa canina* +.

E₁: *Melica altissima* 3, *Humulus lupulus* 2a, *Ballota nigra* 1, *Cuscuta epithymum* 1, *Galium aparine* 1, *Rubus caesius* 1, *Urtica dioica* 1, *Chaerophyllum bulbosum* +, *Aristolochia clematitis* +, *Lactuca serriola* +.

The *Melica altissima* stand at second recent locality near the Plášťovce village (relevé 3) represents probably the association *Conio-Chenopodietum bulbosi* from the alliance *Galio-Alliarion*, class *Galio-Urticetea*. The ruderal vegetation here replaced the former vegetable garden. *M. altissima* has spread to this ruderal site from nearby forest edges situated along rural road. Those forest fringes represent now unfavourable habitats for the species, especially shrub layer is dense so only a few individuals of *M. altissima* surviving here.

Relevé 3: Plášťovce, abandoned site near vineyards, relevé plot size 16 m², exposition SE, elevation 15°, E₁ 65%, 138 m a.s.l., N 48°9'52.4", E 18°57'55.2", 20. 6. 2017, P. Eliáš jun.

E₁: *Melica altissima* 3, *Aristolochia clematitis* 2a, *Arrhenatherum elatius* 2a, *Urtica dioica* 2a, *Artemisia vulgaris* 1, *Humulus lupulus* 1, *Robinia pseudoacacia* juv. 1, *Rubus fruticosus* agg. 1, *Bromus sterilis* +, *Chaerophyllum bulbosum* +, *Cichorium intybus* +, *Galium aparine* +, *Stenactis annua* +.

Summarizing our phytosociological data, *Melica altissima* grows today in communities different from those recorded in the past. Although phytosociological relevés with *M. altissima* are missing from our territory (ROLEČEK 2005; K. HEGEDÜŠOVÁ VANTAROVÁ 2015 in verb.), some authors have mentioned communities with the occurrence of it. MICHALKO (1964) reported the species from the association *Aceri-Carpinetum betuli* Klika 1941 (alliance *Tilio-Acerion*, class *Querco-Fagetea*) in the Bezovec hill, the Považský Inovec Mts. and DOSTÁL & ČERVENKA (1992) from forest vegetation of the alliance *Quercion pubescenti-petraeae*. Even on the basis of these data, it seems that the species has disappeared from more or less natural vegetation and now survives mainly on secondary ruderalized communities in Slovakia (*Chelidonio-Robinion*, *Galio-Alliarion*). It seems, however, that it is able to survive also in such habitats for a long time similarly as *Doronicum hungaricum*, the other rare species of open woodlands and forest edges. Its largest recent population is namely located in the *Robinia pseudoacacia* forest (TURIS 2007). Similarly CSATHÓ (2010) mentioned that *M. altissima* do not need primary sites in the landscape. The species do not indicate primary localities on the loess regions of the Great Hungarian Plain (SE Hungary).

Within *Melica altissima* native distribution range in Central Europe, the species is reported in some communities from Austria, and especially Hungary. WRBKA et al. (2010) found it in semi-ruderal grassland stand described as *Iris variegata-Elymus hispidus-(Geranion)-Gesellschaft* Wrbka, Thurner, Schmitzberger 2010 from the alliance *Geranion sanguinei*. Many grave tracks of wild boars were observed at stands. They can serve as an explanation for the ruderalization effect and presence of some species of the class *Artemisieta vulgaris* (*Artemisia absinthium*, *Ballota nigra*, *Bromus inermis*, *Poa compressa*, *Silene latifolia* or *Berteroa incana*).

In Hungary, where *Melica altissima* is relatively abundant, BORHIDI et al. (2012) mentioned it within two different vegetation types: mesophilic and xerophilic scrubs of the class *Rhamno-Prunetea*, alliance *Spiraeion mediae* Borhidi & Varga Z. 1999 and the submediterranean and subcontinental xerothermic forests

of the class *Quercetea pubescens* (Doing 1955) Scamoni & Passarge 1959, alliance *Aceri tatarici-Quercion*.

In the frame of the alliance *Spiraeion mediae* Borhidi & Varga Z. 1999, *Melica altissima* is a member of at least two associations. *Helleboro odori-Spiraeetum mediae* Borhidi & Morschhauser 2003 occupy cool, north oriented rocky cliffs at 450 to 600 m altitude in a shallow, humusous soil on limestone plains in Southern Hungary (BORHIDI et al. 2003; ERDŐS & MORSCHHAUSER 2010). The second association – *Waldsteinio geoidis-Spiraeetum mediae*, is usually occurring at an altitude of 300 to 750 m above sea level, on limestone and various andesite formations in Northern Hungary (KEVEY 2008). It is much more interesting for us, because the association is mentioned also from the territory of Slovakia (e.g. ELIÁŠ 1993; HRIVNÁK et al. 2004; KLIMENT 2011).

Furthermore, presence of *Melica altissima* in the oak forests from the order *Quercetalia pubescenti-petraeae* was found in four associations of the alliance *Aceri tatarici-Quercion*, thermophilous oak forests on deep soils in the forest-steppe zone of the Pontic-Pannonian region (BORHIDI et al. 2012). On the first hand BORHIDI et al. (l.c.) mentioned *M. altissima* in the *Aceri tatarici-Quercetum pubescenti-roboris* (= the association *Quercetum pubescenti-roboris* sensu JAROLÍMEK et al. 2008). We can assume that *M. altissima* originally grew in a similar type of vegetation in Slovakia on the site near Dolné Semerovce. On the other hand, other three associations are known only from Hungary or countries of South-eastern Europe: the sand forest of the relic of the Danube-Tisza river *Iridi variegatae-Quercetum roboris* (Hargitai 1940) Borhidi in Borhidi & Kevey 1996, *Tilio-Fraxinetum excelsioris* Zólyomi (1934) 1967 of the Carpathian fringes in Hungary and Romania and dry oak forests on saline soils *Galatello-Quercetum roboris* Zólyomi & Tallós 1967.

Acknowledgement

We are grateful to curators of herbaria visited during the study and two anonymous reviewers for valuable comments to the manuscript. The study was supported by grant VEGA No. 1/0083/16.

References

- BARKWORTH M. E. (2007): *Melica* L. – In: BARKWORTH M. E., CAPELS K. M., LONG S., ANDERTON L. K. & PIEP M. P. (eds.): Flora of North America: North of Mexico, Vol. 24, p. 88-102. – Oxford University Press, New York & Oxford.
- BARTHA D., KIRÁLY G., SCHMIDT D., TIBORCZ V., BARINA Z., CSIKY J., JAKAB G., LESKU B., SCHMOTZER A., VIDÉKI R., VOJTKÓ A. & ZÓLYOMI SZ. (eds.) (2015): Magyarország edényes növényfajainak elterjedési atlasza. – Nyugat-magyarországi Egyetem Kiadó, Sopron, 329 pp.
- BAŽÁNY M., UJHÁZOVÁ M. & UJHÁZY K. (2016): Lesné spoločenstvá zväzu *Tilio-Acerion* s dominanciou bukai lesného (*Fagus sylvatica*) na karbonátoch Malých Karpát. – Bull. Slov. Bot. Spoločn. 38(2): 243-264.
- BORHIDI A., MORSCHHAUSER T. & SALAMON-ALBERT É. (2003): A new rock-heath association in the Mecsek Mts (South Hungary). – Acta Bot. Hung. 45: 35-51.

- BORHIDI A., KEVEY B. & LENDVAI G. (2012): Plant communities of Hungary. – Akadémiai Kiadó, Budapest, 544 pp.
- CONERT H. J. (eds.) (1998): Illustrierte Flora von Mitteleuropa / Gustav Hegi.: Bd. 1, Teil 3. Spermatophyta: Angiospermae: Monocotyledones, 1 (2). Poaceae, 3. Aufl. – Blackwell Wissenschafts-Verlag, Berlin & Wien, 898 pp.
- CONN E. E. (1981): 16. Cyanogenic Glycosides. – In: CONN E. E. (ed.): Vol. 7. The Secondary Plant Products, p. 479-498. – Academic Press, New York.
- CSATHÓ A. I. (2008): Mezsgyék kutatása a Körös-Maros Nemzeti Park Igazgatóság működési területén. – Kutatási jelentés, Körös-Maros Nemzeti Park Igazgatóság, Szarvas, 132 pp.
- CSATHÓ A. I. (2010): Elsődleges területeket jelző növényfajok az Alföld löszhátain. – A Puszta 24: 72-82.
- DANIHELKA J. & ŘEPKA R. (1995): *Melica altissima* v Mikulově. – Zprávy Čes. Bot. Společ. 30(1): 107-110.
- DOMINOVÁ S. (2008): Floristický prieskum okolia vrchu Bezovec (Považský Inovec) so zameraním na výskyt divisorastúcich jedlých a liečivých rastlín. – Bc. Thesis. Slovenská poľnohospodárska univerzita, Nitra, 43 pp.
- DOSTÁL J. (1948–1950): Květena ČSR. – Přírodovědecké nakladatelství, Praha, 2269 pp.
- DOSTÁL J. (1958): Klíč k úplné květeně ČSR. Ed. 2. – Nakladatelství ČSAV, Praha, 982 pp.
- DOSTÁL J. & ČERVENKA M. (1992): Veľký klúč na určovanie vyšších rastlín 2. – Slovenské pedagogické nakladateľstvo, Bratislava, 1567 pp.
- ELIÁŠ P. (1993): Vegetácia Chránenej krajinnej oblasti Ponitrie (pohorie Tríbeč a Vtáčnik). 1. Syntaxonomický prehľad rastlinných spoločenstiev (nelesná vegetácia). – Rosalia, Nitra, 9: 49-70.
- ELIÁŠ P. JUN., DITĚ D., KLIMENT J., HRIVNÁK R. & FERÁKOVÁ V. (2015): Red list of ferns and flowering plants of Slovakia, 5th edition (October 2014). – Biologia 70: 218-228.
- ERDŐS L. & MORSCHHAUSER T. (2010): The rock-heath association *Helleboro odor-Spiraeetum mediae* in the Villány Mts (South Hungary). – Nat. Somogy. 17: 7-14.
- FILARZSKY F. (1898): Das Pieninen-Gebirge und seine Flora. – Magyar Kárp. Évk. Jahrb. Ung. Karp.-Ver. 25: 26-87.
- FISCHER M. A., ADLER W. & OSWALD K. (eds.) (2005): Exkursionsflora für Österreich, Lichtenstein und Südtirol. 2. Aufl. – Land Oberösterreich, Biologiezentrum der Oberösterreichischen Landesmuseen, Linz, 1380 pp.
- FUTÁK J. (1980): Phytogeographical division of Slovakia (1: 1 000 000). – In: MAZÚR E. (ed.): Atlas Slovenskej socialistickej republiky, p. 88. – SPN, Bratislava.
- GALGÓCI M. & ŠTRBA P. (2008): Sutinové lesy asociácie *Aceri-Tilietum* Faber 1936 v Malých Karpatoch. – In: RÓZOVÁ Z. (ed.): Mladí vedci 2008: vedecké práce doktorandov a mladých vedeckých pracovníkov, p. 47-53. – Univerzita Konštantína Filozofia v Nitre, Nitra.
- GALGÓCI M., ŠTRBA P. & BRANÁ M. (2009): Výskyt chránených a ohrozených rastlín na území PR Kamenec, NPR Záruby a PR Buková (Malé Karpaty). – In: OMELKA R., KUNA R., BOLEČEK P. & STREJČEK F. (eds.): 5 Biologické dni, p. 48-52. – Univerzita Konštantína Filozofia v Nitre, Nitra.
- GEDERAAS L., MOEN T. L., SKJELSETH S. & LARSEN L.-K. (eds.) (2012): Alien species in Norway with the Norwegian Black List 2012. – The Norwegian Biodiversity Information Centre, Norway, 212 pp.
- GŁAZEK T. (1997): Nowe dla Polski stanowiska *Melica altissima* (Poaceae). – Fragm. Flor. Geobot. 4: 374-377.
- GOLIAŠOVÁ K. & MICHALKOVÁ E. (eds.) (2016): Flóra Slovenska VI/4. – Veda, Bratislava, 778 pp.

- GOLIŃSKA B., SWĘDRZYŃSKI A. & KOZŁOWSKI S. (2003): Biological and chemical properties of *Melica altissima* (Poaceae) from the point of view of its use value. – In: FREY L. (ed.): Problems of grass biology, p. 397-402. – W. Szafer Institute of Botany, PAS, Kraków.
- GREEN P. R. (2009): First British record for self-sown *Melica altissima*? – Botanical Society of the British Isles News 112: 34.
- GUDŽINSKAS Z. (2017): Alien herbaceous plant species new to Lithuania. – Bot. Lith. 23(1): 33-42.
- HEMPEL W. (1973): Die systematische Stellung von *Melica altissima* L. und des *Melica minuta* L.-*Melica ramosa* Vill.-Komplexes (*Melica* L. Subgen. *Altimelica* Hempel) (Vorarbeiten zu einer Revision der Gattung *Melica* L. — III). – Fedes Repert. 84(7-8): 533-568.
- HERBICH F. (1834): Botanischer Ausflug in die galizisch-karpatischen Alpen des Sandezer Kreises. – Flora 17: 561-575.
- HOHLA M. (2003): „Plants on the road“ – neue Pflanzen begleiten unsere Straßen. – ÖKOL 25(2): 11-18.
- HOLUB J. & MICHALKO J. (1999): *Melica altissima* L. – In: ČEŘOVSKÝ J., FERÁKOVÁ V., HOLUB J., PROCHÁZKA F. & MAGLOCKÝ Š. (eds.): Červená kniha ohrozených a vzácných druhov rastlín a živočíchov ČR a SR, vol. 5 (Vyššie rastliny), p. 242. – Príroda, Bratislava.
- HRIVNÁK R., KLIMENT J., BERNÁTOVÁ D., BLANÁR D., HÁJEK M., HÁJKOVÁ P., JAROLÍMEK I., UHLIAROVÁ E., UJHÁZY K., VALACHOVIČ M. & ZALIBEROVÁ M. (2004): Prehľad rastlinných spoločenstiev uvádzaných z Muránskej planiny a bezprostredne susediacich území. – Reussia 1(Suppl. 1): 191-214.
- JAROLÍMEK I., ŠIBÍK J., HEGEDÜŠOVÁ K., JANÍŠOVÁ M., KLIMENT J., KUČERA P., MÁJEKOVÁ J., MICHÁLKOVÁ D., SADLNOVÁ J., ŠIBÍKOVÁ I., SKODOVÁ I., UHLIŘOVÁ J., UJHÁZY K., UJHÁZOVÁ M., VALACHOVIČ M. & ZALIBEROVÁ M. (2008): A list of vegetation units of Slovakia. – In: JAROLÍMEK I. & ŠIBÍK J. (eds): Diagnostic, constant and dominant species of the higher vegetation units of Slovakia, p. 295-329. – Veda, Bratislava.
- JURKO A. & KONTRÍŠ J. (1982): Submontánne sutinové lesy v Malých Karpatoch. – Biológia 37(5): 495-501.
- KALCHBRENNER K. (1853): Einige Bemerkungen über den Berg Drevenyk den Standort der von mir aufgefunderien *Carex pediformis*. – Verh. Zool.-Bot. Ges. Wien III. Sitzber.: 134-135.
- KEVEY B. (2008): Magyarország erdőtársulásai (Forest associations of Hungary). – Tilia 14: 1-488.
- KIRÁLY G. (ed.) (2007): Vörös Lista. A magyarországi edényes flóra veszélyeztetett fajai. – Saját kiadás, Sopron, 73 pp.
- KLIMENT J. (2011): Fytocenologické postrehy z Jelšavského krasu. – Bull. Slov. Bot. Spoločn. 33(2): 221-234.
- KNAPP J. A. (1872): Die bisher bekannten Pflanzen Galiziens und der Bukowina. – Wilhelm Braumüller, Wien, 520 pp.
- KOŠTÁL J. (2008): *Melica altissima* [report]. – In: ELIAŠ P. jun. (ed.): Zaujímavejšie floristické nálezy. – Bull. Slov. Bot. Spoločn. 30(2): 290.
- MAJTÁN M. (1972): Názvy obcí na Slovensku za ostatných dvesto rokov. – Vydavateľstvo SAV, Bratislava, 672 pp.
- MAJTKOWSKI W. & MAJTKOWSKA G. (1998): Gatunki alternatywne traw i możliwości ich wykorzystania na terenach zdegenerowanych i zdewastowanych. – Arch. Ochr. Środow. 24(3): 111-121.
- MARHOLD K. & HINDÁK F. (eds.) (1998): Checklist of nonvascular and vascular plants of Slovakia. – Veda, Bratislava, 687 pp.

- MICHALKO J. (1964): *Melica altissima* L. v pohorí Považský Inovec. – Biologia 19: 876.
- MIREK Z. & PIĘKOŚ-MIRKOWA H. (2008): Czerwona księga Karpat Polskich. – Instytut Botaniki PAN, Kraków, 616 pp.
- MOLNÁR Cs. (2014): Florisztikai adatok a Harangod és a Dél-Cserehát löszvidékéről. – Kitaibelia 19(1): 105-113.
- MOLNÁR Cs. & TÜRKE I. J. (2007): Adatok az Eperjes-Tokaji-hegylánc déli felének növényvilágából. – Kitaibelia 12(1): 108-115.
- MOLNÁR Cs., LENGYEL A., MOLNÁR V. A., NAGY T., CSÁBI M., SÜVEGES K., LENGYEL-VASKOR D., TÓTH GY. & TAKÁCS A. (2016): Pótlások Magyarország edényes növényfajainak elterjedési atlaszához II. – Kitaibelia 21(2): 227-252.
- NIKLFELD H. (1971): Bericht über die Kartierung der Flora Mitteleuropas. – Taxon 20: 545-571.
- NIKLFELD H. & SCHRATT-EHRENDORFER L. (1999): Rote Liste gefährdeter Farn- und Blütenpflanzen (Pteridophyta und Spermatophyta) Österreichs. – In: NIKLFELD H. (ed.): Rote Listen Gefährdeter Pflanzen Österreichs. 2. neu bearbeitete Auflage. – Bundesministerium für Umwelt, Jugend und Familie, Graz, 292 pp.
- PANTOCSEK J. (1907): Pozsony és környékének természettárajzi viszonyai. – In: FISCHER J., ORTVAY T. & POLIKEIT K. (eds.): Emlékmű 1856-1906. A Pozsonyi Orvos-Természettudományi Egyesület fennállásának ötvenedik évfordulója alkalmából, p. 181-262. – Pozsony.
- ROLEČEK J. (2005): Vegetation types of dry-mesic oak forests in Slovakia. – Preslia, Praha, 77: 241-261.
- SALLAINÉ KAPOCSI J., JAKAB G., CSATHÓ A. I., PENKSZA K. & TÓTH T. (2012): A Dél-Tiszántúl növényfajainak Vörös Listája. – In: JAKAB G. (ed.): A Körös-Maros Nemzeti Park növényvilága. A Körös-Maros Nemzeti Park természeti értékei I., p. 380-399. – Körös-Maros Nemzeti Park Igazgatóság, Szarvas.
- SCHMITZBERGER I., THURNER B. & WRBKA T. (2010): *Melica altissima* und *Stipa dasypylla* – Populationsmonitoring für zwei floristische Besonderheiten im Nationalpark Thayatal. – Wiss. Mitt. Niederöster. Landesmuseum 21: 195-208.
- SCHMOTZER A. (2014): A Hevesi-sík flórakutatásának eredményei. – In: SCHMOTZER A. (ed.): Szikfok. – Dél-hevesi tanulmányok, p. 25-68. – Bükk Nemzeti Park Igazgatóság, Eger.
- STANKOV S. S. & TALIEV V. I. (1949): Opredeliteľ vysých rastenij Evropejskoj časti SSSR. – Sovjetskaja Nauka, Moskva, 1032 pp.
- ŠMARDA J. (1961): Vegetační poměry Spišské kotliny. – SAV, Bratislava, 268 pp.
- THIERS B. (2017): Index Herbariorum: A global directory of public herbaria and associated staff. – New York Botanical Garden's Virtual Herbarium, New York.
http://sweetgum.nybg.org/ih/ [accessed September 17. 2017]
- TOKARSKA-GUZIK B., DAJDOK Z., ZAJĄC M., ZAJĄC A., URBISZ A., DANIELEWICZ W. & HOŁDYŃSKI C. (2012): Rośliny obcego pochodzenia w Polsce ze szczególnym uwzględnieniem gatunków inwazyjnych. – Generalna Dyrekcja Ochrony Środowiska, Warszawa, 197 pp.
- TURIS P. (2007): Kamzičník podlhovastolistý (*Doronicum hungaricum* Rchb. fil.) na Slovensku. – Phytopedon 6: 1-9.
- TUTIN T. G. (1980): *Melica* L. – In: TUTIN T. G., HEYWOOD V. H., BURGES N. A., MOORE D. M., VALENTINE D. H., WALTERS S. M. & WEBB D. A. (eds.): Flora Europaea, 5: 178-179. – Cambridge University Press, Cambridge.
- VOZÁROVÁ M. & SUTORÝ K. (eds.) (2001): Index herbariorum Reipublicae bohemicae et Reipublicae slovacae. – Bull. Slov. Bot. Spoločn., Bratislava, Suppl. 7, 95 pp.
- WESTHOFF V. & VAN DER MAAREL E. (1978): The Braun-Blanquet approach. – In: WHITTAKER R. H. (ed.): Classification of plant communities, p. 289-399. – W. Junk, The Hague.

- WRBKA T., ZMELIK K., SCHMITZBERGER I. & THURNER B. (2010): Die Vegetation der Wälder, Wiesen und Trockenrasen des Nationalparks Thayatal - ein erster Überblick. – Wiss. Mitt. Niederösterr. Landesmuseum 21: 67-134.
- ZHENLAN W. & PHILLIPS S. M. (2006): *Melica* L. – In: Wu Z.Y., RAVEN P.H. & HONG D.Y. (eds.): Flora of China, 22: 216-223. – Beijing & St. Louis.

Appendix 1. The list of revised herbarium specimen and related literature data of *Melica altissima* in Slovakia.

Native occurrence

Pannonicum: **2. Ipeľsko-rimavská brázda region:** Šahy, Kalvária Hill, steppe hillside over the vineyards, 170 m (Švec 1947 LTM). – Dolné [Veľké] Semerovce, forest edge NE from the settlement (Kopecký 1963 PR; Eliáš jun. 2011, 2017 NI). – Plášťovce, in the surrounding of the village (Dočolomanský 1958 BRA). – Plášťovce, the edge of the road near wine cellars W of the village (J. Košťál 2008 NI, 2008; Eliáš jun. 2011, 2017 NI). **6.** **Podunajská nížina lowland:** Bratislava [Pozsony], sunny and rocky sites and vineyards near the town, 160 m (Pantocsek 1907: 207; Hanschel 1933 PR).

Carpaticum: **10. Malé Karpaty Mts.:** Buková [Biksard], along the touristic path between ruins of the Ostrý Kameň castle and Záruby Hill, NW slopes, 550 – 750 m (Sillinger 1926 BRNU, PR, PRC; Grebenščíkov 1954 SAV; Krippelová 1960 SAV; Pokluda 1961 BRA, BRNM; Dvořák 1963 BRA; Černoch 1964 BRNM; Skřivánek 1964 BRNM). – Čelo Hill (Berta et Medovič 1955 SLO). – Veterlín [Vetrlík] Hill (F. Nábělek 1938 SAV). – Smolenice, near the Smolenice castle (Ptačovský 1928 SAV). **11. Považský Inovec Mts.:** Bezovec Hill, rocks on the top of the hill, 740 m (Michalko 1959 SAV, 1964; Michalko et Magic 1964 SAV; Májovský 1970 SLO; Nevrly 1972 BRA, BRNU, PR). **26b.** **Spišská kotlina Basin:** Spišské Vlachy [Wallendorf] (Veselský 1855 PRC). = Spišské Podhradie [Kirchdrauf], Dreveník [Drevenyik] (Hazslinszky 1874 BRA; Hazslinszky sine dato BRNU, PR; Kalchbrenner sine data BRA, 1853; Greschik 1880 SLO, 1887 SLO, 1934 SLO, 1942 SLO).

Cultivation or probably escaped from cultivation

6. Podunajská nížina lowland: Bratislava [Pozsony], cultivated in botanical garden (Szép 1915 BRA, NI). **16. Štiavnické vrchy Mts.:** Banská Štiavnica, shrub vegetation in the settlement along path to Paradajz hill (Č. Deyl 1968 OLM).

Common data

2. Ipeľsko-rimavská brázda region: Šahy district (Kopecký 1961 PR). **26b Spišská kotlina basin:** near the Prešov [Eperjes] town (Hazslinszky 1860 BRNU).

Received: October 23rd 2017
 Revised: November 29th 2017
 Accepted: November 29th 2017