

Rare North American migrant Fall Panicum (*Panicum dichotomiflorum* Michx., Poaceae) in Slovakia

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Abstract: *Panicum dichotomiflorum* is a North American synanthropic taxon. The species was found only rarely in Slovakia in the Podunajská nížina lowland, the Ipeľ Basin, the Východoslovenská nížina lowland, Tribeč Mts and the Nízke Beskydy Mts until the late 1970s. Eleven localities are known in total. Since 2000, it was confirmed only in five sites: Ladice (SW Slovakia, Carpathians), Leopoldov, Zlaté Moravce (both SW Slovakia, Pannonian region), Abovce (Central Slovakia, Pannonian region) and Humenné (E Slovakia, Carpathians). It is most often found around railway corridors and is also starting to appear in ruderal habitats in cities and fields (3 localities since 2019). Its occurrence is mostly casual; it has been found repeatedly only rarely (Čierna nad Tisou, Humenné) and was naturalized only at single locality (Abovce).

Keywords: Central Europe, dataset, dynamics, habitats, *Panicum*, spreading.

Introduction

Genus *Panicum*, a large pantropical genus extending into temperate regions of North America and Eurasia, included formerly about 500 taxa of annual as well as perennial grass species. Today, it includes 163 described species with the center of species diversity mainly in tropical and subtropical regions (Zuloaga et al. 2018).

Several members of the genus are considered valuable cereals (*Panicum miliaceum*), forage crops and raw materials for biofuels (*P. coloratum*, *P. maximum*, *P. virgatum*), but several species are also considered serious weeds (*P. capillare*, *P. dichotomiflorum*, *P. schinzii*) (Verloove 2001; Chen & Renvoize 2006).

Up to 16 aliens cultivated, ornamental or weedy *Panicum* taxa are reported in Europe (Verloove 2001; Valdés & Scholz 2009+). *Panicum dichotomiflorum*, the type taxon of the sect. *Dichotomiflora* (Hitchc.) Hitchc. & Chase ex Honda (Zuloaga 2022), also belongs to them. The species original distribution range reached in South America, northern Mexico, the eastern part of the USA and the Antilles (Holm et al. 1979; Wipff 2003; Fuentes et al. 2013), it was widely naturalized in some parts of Europe, Asia and New Zealand (Verloove 2001; Edgar & Connor 2010; Barina et al. 2013) and was also sporadically found in the Central Europe shortly before of WW II (Conert 1979; Koltzenburg 2024).

Panicum dichotomiflorum is annual or short-lived perennial grass with basally branched stems, usually glabrous sheaths and leaf blades. Secondary or tertiary panicle branches are appressed. Spikelets acute, 3–3.5 mm long, well-developed, lower lemma 7–9-veined. It grows in open, often wet, disturbed areas: fields, roadsides, ditches (Clayton 1980; Chen & Renvoize 2006; Sukhorukov 2011). The intraspecific taxonomy of *P. dichotomiflorum* remains unclear. In Europe, two taxa have been traditionally distinguished, primarily at the varietal level: var. *dichotomiflorum* and var. *geniculatum* (Tab. 1; Jehlík 1998; Verloove 2001). In contrast, Wipff (2003) recognized two subspecies. The nominate subsp. *dichotomiflorum*, comprising var. *dichotomiflorum* and var. *puritanorum* (Tab. 1). Variety *geniculatum*, which is characterized by having geniculate, succulent stems was included with var. *dichotomiflorum*. Another distinct taxon, the robust subsp. *bartowense*, is characterized by pilose (with tuberculate-based hairs) leaf sheaths and culms reaching up to 2 m in height. However, its occurrence in Central Europe is unlikely, as it is native to tropical wetlands in the southeastern USA (POWO 2026). In Slovakia, *P. dichotomiflorum* has occurred since the late 1970s and its occurrence was monitored in more detail until the end of the century (Jehlík 1998). Currently, we do not have a summary of current data on the occurrence of this species. The aim of this paper is to fill this gap, in which we deal with the i) overall distribution and recently confirmed localities, ii) dynamics of spreading and iii) habitat characteristics of the species.

Material and Methods

The study was conducted between 2022 and 2025, focusing on the distribution of *Panicum dichotomiflorum* in Slovakia. Data were compiled based on own field research and a revision of herbarium specimens from 17 collections (BP, BRA, BRNM, BRNU, Herbarium of the Ponitrie Landscape Protected Area, KO, LTM, NI, PMK, PR, PRA, PRC, SAV, SLO, SMBB, ZAM, ZV). Herbarium acronyms follow Thiers (2024+), and regional herbaria are listed according to Vozárová & Sutorý (2001).

Tab 1. Significant determining characteristics of *Panicum dichotomiflorum* varieties (according to Jehlík 1998, Verloove 2001, and Wipff 2003).

	subsp. <i>dichotomiflorum</i>		var. <i>geniculatum</i>
	var. <i>dichotomiflorum</i>	var. <i>puritanorum</i>	
Culms	erect or ascending, 2 – 3 mm thick, without adventitious roots	erect, 0.4 – 1 mm thick, without adventitious roots	ascending or prostrate, 3 – 6 mm thick, sometimes with adventitious roots
Leaf sheets	poorly inflated or not inflated	not inflated	usually noticeably inflated
Leaf blade width	4 – 10 mm	1 – 8 mm	6 – 20 mm
Inflorescence	apical, completely protruding from the leaf sheath	apical, completely protruding from the leaf sheath	lateral, not protruding from the leaf sheath
Spikelets	2.4–3.6 mm long	1.6–2.5 mm long	2.4–3.6 mm long

In addition to herbarium vouchers, data were sourced from published and manuscript works, utilizing the floristic database of the Department of Taxonomy of Higher Plants (Institute of Botany, Slovak Academy of Sciences, Bratislava) and the Virtual Herbaria web (<https://herbarium.univie.ac.at/database/collections.htm>).

The results are presented in a dot map designed in Corel Draw, using the grid mapping method described by Niklfeld (1971). The nomenclature of vascular plants follows Kliment et al. (2025), nomenclature of *Panicum* is according to Wipff (2003).

Results and Discussion

The species is rare in Slovakia, only eleven localities were reliably documented (see Appendix, Fig. 1), all individuals morphologically correspond to var. *dichotomiflorum*. This confirms older data published by Jehlík (1998). There is also one literary reference that is not supported by the herbarium voucher. Kontrišová (1980) reported the species from meadows near the railway line near the village of Lovča (central Slovakia, the Žiarska kotlina Basin). Since it is not certain whether it was actually *P. dichotomiflorum*, we did not include this reference in the list of localities as well as on the map.

As review of herbarium and published data shows, *P. dichotomiflorum* has been recorded since the late 1970s in the southernmost areas in Slovakia: the first locality was found in southwestern Slovakia (1978 – Bratislava), the second in southeastern Slovakia (1980 – Čierna nad Tisou). Jehlík et al. (2017) pointed out as first year of occurrence 1977, but without specifying the locality. Other localities were discovered mainly in SW Slovakia (Leopoldov, Levice, Šurany, Zlaté Moravce), it was sporadically found in the Ipeľská kotlina Basin (Lučenec), and again in E Slovakia (Humenné) (Feráková 2002). The last site is the first record from the Carpathian region. Currently (after 2000) five sites are confirmed: Abovce, Leopoldov, Zlaté Moravce in Pannonian region and Ladice (Košťál 2022) as well as Humenné in the Carpathians (Fig. 1).

Comparing the years of herbarium specimen collection, we also found that in some localities fall panicum can survive for a long time – V. Jehlík collected the species in Čierna nad Tisou railway transshipment in years 1980 – 1993, but it was not confirmed recently (Májeková et al. 2021). Similarly, it was observed repeatedly in Humenné (1995 – 2024). Overall, however, it can be stated that the species was present just temporarily in most localities and with restricted area of occupancy, local intensive spreading was found only in Abovce (Barina et al. 2020). So, *P. dichotomiflorum* is still at the beginning of the naturalization phase in Slovakia, it is not invasive (Medvecká et al. 2012).

The question of origin is also interesting. Jehlík (1998) originally stated that fall panicum probably reached Slovakia via a southern migration route from southeastern and southern Europe (Hungary, Romania, Croatia). Later, Jehlík & Dostálek (2008) stated that it was originally imported with the grain from the former Soviet Union. In the mid-1960s, Czechoslovakia imported almost 900,000 tons of grain from the Soviet Union (Kaplan 2000). However, this was often a re-export, the grain originally came from Canada (Jehlík & Dostálek 2008), where the Soviet Union purchased large volumes even in the 1970s and 1980s (Becker 1984). *P. dichotomiflorum* was already a serious weed in Canada at that time, especially in corn and soybeans (Baskin & Baskin 1983). Therefore, the second possibility is the import of soybeans of North American origin, which Jehlík (1998) stated as the main way of introducing fall panicum to the Czech Republic. The Bratislava railway station branch was also used for the import of various agricultural commodities, and the soybeans were processed by the nearby Palma Bratislava factory, which was oriented towards the complete processing of oilseeds, e.g. oilseed meal for feed

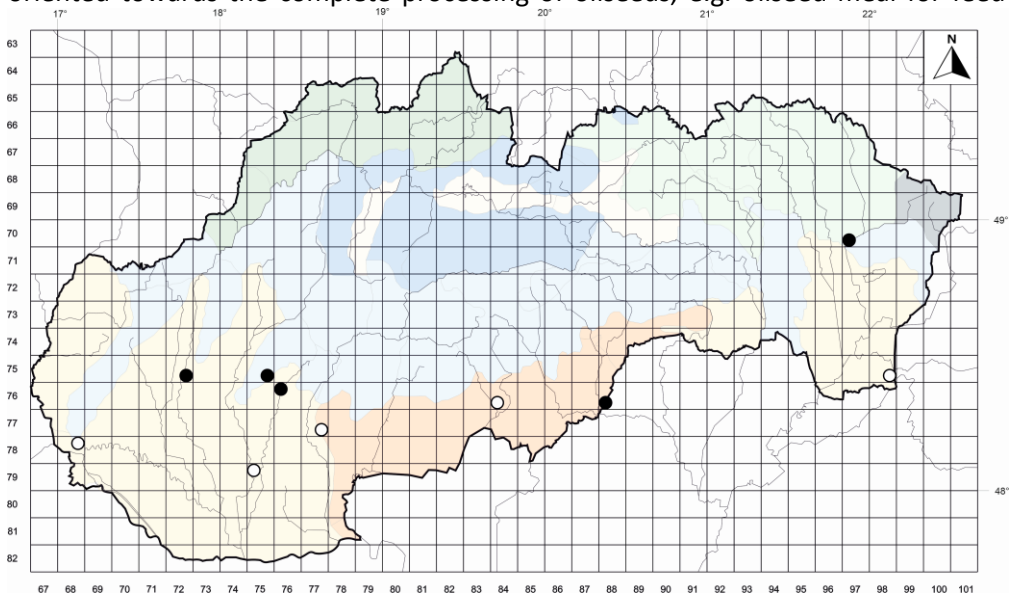


Fig. 1 Distribution of *Panicum dichotomiflorum* in Slovakia: empty circles – occurrences before 2000, black circles – occurrences since 2000. Yellow and orange areas represent the area of Pannonian thermophilic flora; areas of other colors represent the mountains and basins of the Carpathians (according to Futák 1984).

purposes. It therefore seems most likely that the species reached southwestern Slovakia via the Elbe migration route and eastern Slovakia via the eastern migration route. However, it has recently been detected spreading from the south, from field crops in Hungary (Molnár & Virók 2018; Barina et al. 2020).

Although the small number of *P. dichotomiflorum* localities gives only a limited possibility to study the dynamics of the spread, it seems that a certain trend is evident. The largest number of localities was found in the eighties and nineties, then the intensity of occurrence decreases, and a larger number of sites have only been discovered in recent years (Fig. 2). Very similar trend is shown by the more common North American taxon *Panicum capillare* subsp. *capillare* – the number of its localities was highest in the period 1976 – 2000 and then gradually decreased (Kotlářová 2025). This is clearly different from other North American invasive weed species such as *Ambrosia artemisiifolia*, *Artemisia annua* and *Euphrosyne xanthiifolia* (syn. *Iva xanthiifolia*), whose localities are constantly increasing (Follak et al. 2013; Hrabovský & Mičieta 2014, 2018; Hrabovský et al. 2024). We assume that this was

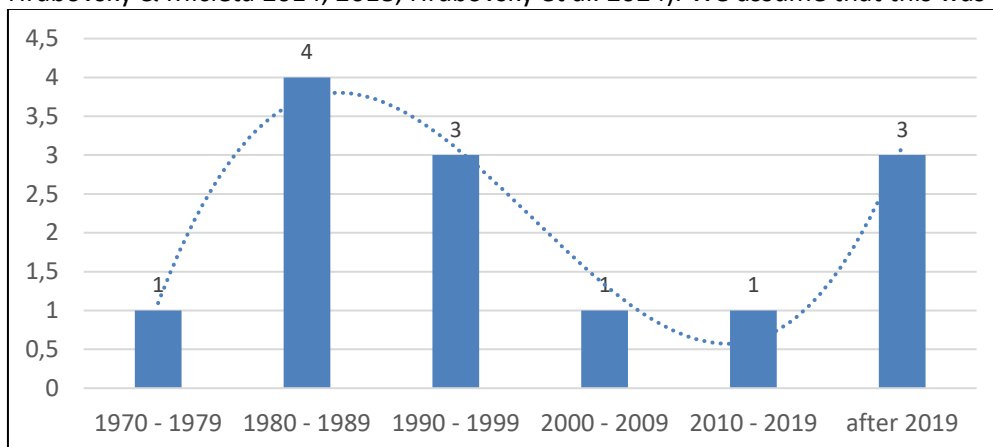


Fig. 2 Dynamic of spreading of *Panicum dichotomiflorum* in Slovakia.

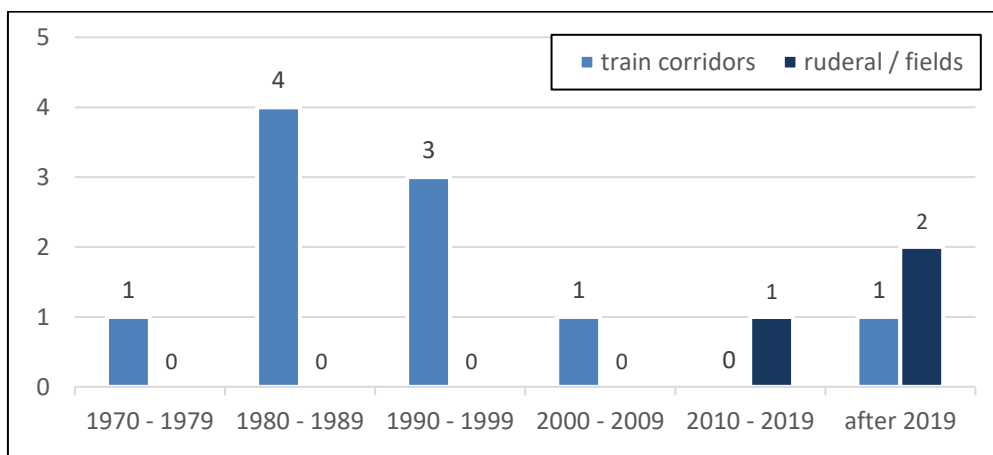


Fig. 3 Habitat types occupying by *Panicum dichotomiflorum* in Slovakia.

caused more by suitable climatic conditions ensuring generative reproduction in the 1980s and 1990s or change in the management of train corridors (application of herbicides) than by the cessation of grain imports from the former Soviet Union. *P. dichotomiflorum* is a late summer species, the grains ripen only in late August and September (mowed plants ripen only in October). Herbicide-treated and mowed rail tracks, where the grain ripening could be reduced in the cold October, probably contributed to limiting the spread of the species in Slovakia. For this reason, fall panicum failed to penetrate beyond the railway tracks in Slovakia and has only recently been found in ruderal habitats and fields (Fig. 3). In Hungary, where temperature conditions are more suitable, *Panicum dichotomiflorum* has become established in various disturbed vegetation types, on waste grounds, next to puddles, along moist or wet roadsides, at railway stations, in some plains and hills (Csiky et al. 2004), from there it was spread to the edges of the fields near Abovce (Barina et al. 2020). The only locality detected in the urban area of the Zlaté Moravce town as well as locality in abandoned quarry near Ladice are probably related to contaminated bird feed (spilled directly from the feeder or as part of household biological waste). This source of diaspores was also behind the introduction of *Eleusine indica* and *Salvia hispanica* in Slovakia (Dítě et al. 2019; Eliáš et al. 2023).

Finally, the prognosis of Jehlík (1998) was not fully confirmed. The author assumed successful naturalization and expansion in the southern regions of Slovakia. On the contrary, as we found, the occurrence is still sporadic, temporary in localities – during our field research we were unable to confirm any locality except for Humenné. Fall panicum also disappeared from the largest transshipment point of goods from Eastern Europe in Čierna nad Tisou, although it was recently detected in nearby Chop in Ukraine (Májeková et al. 2021). We therefore assume that this situation will persist and *P. dichotomiflorum* can continue to be assessed mostly as a casual alien in Slovakia. We can also state that it does not pose a direct threat to agricultural production, although first indications have appeared (field edges near Abovce). On the other hand, in some areas of Central and Eastern Europe it is already becoming a noxious weed and its spread requires attention (Csiky et al. 2004; Fischer et al. 2008; Sukhorukov 2011; Maslo & Šarić 2016; Burul et al. 2020; Molnár & Virók 2018).

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Apendix

Dataset of *Panicum dichotomiflorum* localities in Slovakia. The localities are sorted according to phytogeographic units (Futák 1984).

Pannonial region:

6. Podunajská nížina Lowland

Bratislava, Bratislava railway station-branch, 138 m asl. (Eliáš 1978 SAV).

Leopoldov, railway station, near the north side of the station building, 141 m asl. (Feráková 2001 SLO; Feráková 2002).

Šurany, railway station, 120 m asl. (Dostálek & Jehlík 1985 PR).

Zlaté Moravce, railway track at the station, 182 m asl. (Jehlík 1982 PRA).

Zlaté Moravce, edge of sidewalk in the city, 187 m asl. (Eliáš sen. 2023 NI).

2. Ipeľsko-rimavská brázda region

Levice, railway station, 160 m asl. (Dostálek et Jehlík 1985 PR).

Lučenec, train station, 183 m asl. (Eliáš sen. 1991 NI).

Abovce, fields edges around Slovak-Hungarian border, 176 – 206 m asl. (Molnár & Virók 2019 BP; Barina et al. 2020).

8. Východoslovenská nížina Lowland

Čierna nad Tisou, in the railway station, 103 m asl. (Jehlík 1980 PR, 1993 PR; Dostálek & Jehlík 2008; Jehlík et al. 2017).

Carpathians

10. Tribeč Mts

Ladice, under an abandoned quartzite quarry, area under a waterworks with exposed soil substrate, 230 m asl. (Košťál 2021 Herbarium of the Ponitrie Landscape Protected Area; Košťál 2022).

30c. Nízke Beskydy Mts

Humenné, east of the train station, 148 m asl. (Mikoláš 1995 KO).

Humenné, railway station, gravel areas opposite the main building, 148 m asl. (Eliáš jun., Kotlářová et Tomovičová 2024 NI).

Doubtful locality:

14b. Vtáčnik Mts

Lovča, Pod Bralom site, elevation point 236,3 m asl. (Kontrišová 1980).