Acta Societatis Botanicorum Poloniae

Article ID: 162050
DOI: 10.5586/asbp/162050

Publication History
Received: 2023-02-13
Accepted: 2023-03-10
Published: 2023-06-06

Handling Editor
Marta Kolanowska; University of Łódź, Poland; https://orcid.org/0000-0001-5347-5403

Authors' Contributions
MN: research concept and design; MN, SW, EK, AN, AW, AgN, BP, SŚ, W-LC, PK, MK, BL, SN, RP, ÓSP, AZ: collection and/or assembly of data; MN, SW, EK, AN, AW, AgN, BP, SŚ, W-LC, PK, MK, BL, SN, RP, ÓSP, AZ: data analysis and interpretation; MN, SW, EK, AN, AW, AgN, BP, SŚ, W-LC, PK, MK, BL, SN, RP, ÓSP, AZ: writing the article; MN, EK, AW, AN, AgN, BP, SN, RP: critical revision of the article

Funding
Marcin Nobis's research was financially supported by the National Science Centre Poland, grant number UMO-2018/29/B/NZ9/00313; Ewelina Klichowska's research was financed by the National Science Center Poland, grant number 2020/39/D/NZ8/02307; research visits of Beata Paszko to herbaria in Beijing (PE), Chengdu (CDBI), Kunming (KUN) and Sankt Petersburgh (LE) were supported by the exchange programs between the Polish Academy of Sciences and counterpart National Academies, and to Edinburgh (E), London (BM, K), Paris (P) and Vienna (W) by SYNTHESYS Projects (grant nos. FR-TAF-6137, GB-TAF-2262, GB-TAF-4900, AT-TAF-6826) financed by the European Community Research Infrastructure Action under the FP7 'Capacities' Programme.

NEW FLORISTIC FINDINGS

New national and regional plant records: Contribution to the flora of the Old World countries

Marcin Nobis [1*], Sławomir Wróbel [2], Ewelina Klichowska [1], Arkadiusz Nowak [3,4], Anna Wróbel [1,5], Agnieszka Nobis [1], Beata Paszko [6], Sebastian Świerszcz [3,7], Wen-Li Chen [8], Paweł Kauzal [2], Marta Krzempek [1], Bing Liu [8], Sylwia Nowak [9], Renata Piwowarczyk [10], Óscar Sánchez Pedraja [11], Antoni Zięba [2]

[1] Institute of Botany, Faculty of Biology, Jagiellonian University, Gronostajowa 3, 30-387 Kraków, Poland
[2] Tatra National Park, Kuźnice 1, 34-500 Zakopane, Poland
[3] Polish Academy of Sciences, Botanical Garden – Center for Biological Diversity Conservation in Powsin, Prawdziwka 2, 02-973 Warszawa, Poland
[4] Department of Botany and Nature Protection, Faculty of Biology and Biotechnology, University of Warmia and Mazury in Olsztyn, Plac Łódzki 1, 10-721, Olsztyn, Poland
[5] Doctoral School of Exact and Natural Sciences, Jagiellonian University, Prof. S. Łojasiewicza 11, 30-348, Kraków, Poland
[6] Molecular Biogeography and Systematics Group, W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, 31-512 Kraków, Poland
[7] The Franciszek Górski Institute of Plant Physiology, Polish Academy of Sciences, Niezapominajek 21, 30-239 Kraków, Poland
[8] State Key Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Chinese Academy of Sciences, CN-100093 Beijing, PR China
[9] Institute of Biology, University of Opole, Oleska 22, 45-052 Opole, Poland
[10] Center for Research and Conservation of Biodiversity, Institute of Biology, Jan Kochanowski University, Uniwersytecka 7, 25-406 Kielce, Poland
[11] Grupo Botánico Cantábrico, E-39722 Liérganes (Cantabria), Spain

[*] Corresponding author. Email: m.nobis@uj.edu.pl

Abstract

This paper presents new data on the occurrence of 16 vascular plant species from five Eurasian countries obtained during field explorations, as well as during taxonomic revisions of herbarium materials. Five taxa (*Draba fladnizensis*, *Gentiana orbicularis*, *Helianthus giganteus, Symphyotrichum cordifolium, Thalictrum alpinum*) are recorded for the first time from Poland, five (*Achnatherum jacquemontii*, *Arrhenatherum elatius*, *Dittrichia graveolens, Geranium pyrenaicum, Stipa × balkanabatica)* from Tajikistan, three (*Achnatherum sibiricum*, *Asyneuma thomsonii*, *Stipa × balkanabatica*) from Kyrgyzstan, one (*Orobanche bartlingii*) from Turkey, one (*Calamagrostis obtusata*) from China and one (*Calamagrostis emodensis*) from the Gansu Province in China. In addition, *Hieracium piliferum*, considered extinct in Poland, was rediscovered. For each species, synonyms, taxonomy with remarks on recognition and differentiation of the species from the most similar taxa occurring in a given area, general distribution, habitat preferences, as well as a list of recorded localities (often far from the previously known areas) are presented. As a result of the morphological comparison of specimens representing *Stipa × balkanabatica* collected in Tajikistan and Kyrgyzstan with the type specimen collected from Turkmenistan, we decided to describe a new variety named *S. × balkanabatica* var. *alaiensis* M. Nobis & Klichowska, *var. nov.* Additionally, based on the analysis of phytosociological relevés prepared during field studies in the western Pamir Alai Mts (in Kyrgyzstan and Tajikistan), a new association of chasmophytic plants named *Asperulo oppositifoliae–Achnatheretum jacquemontii* M. Nobis, Klichowska & A. Nowak, is also described.

Keywords
alien species; Asia; chorology; diversity; Europe; native species; taxonomy

Introduction

Detailed knowledge of the flora of any area is crucial to recognize patterns and understanding the processes affecting biodiversity as well as to point out the ways of its conservation, both at a local and global scale (Gaujour et al., 2012). Being under increasing pressure from human activities and recently also under the negative impact of global climate warming, the dynamics of both flora and vegetation in the last decades have been much faster than they used to be (Araújo & Rahbek, 2006; Bellard et al., 2012). These changes are reflected in the progressing decline of the species sensitive to environmental changes as well as in the spread of invasive alien species, negatively affecting natural ecosystems and their services important for human well-being. Information on the occurrence of species in areas previously not occupied by them, unnoticed or misidentified with other species, is of great interest and continues to be published (e.g., Bulakh et al., 2022; Dudáš et al., 2022; Ellis et al., 2022; Nobis et al., 2019b; Raab-Straube von & Raus, 2022; Tlałka et al., 2021; Verkhozina et al., 2022) since each new floristic record broadens our knowledge of the species spatiotemporal dynamics and contributes to more effective management of natural resources.

This paper is a continuation of the previous works (e.g., Nobis et al., 2014, 2018, 2019b, 2019c) and is dedicated to new findings on the distribution and taxonomy of vascular plants, or simpler, to plants new to the flora of selected countries (or their significant regions) in the Old Word (including Europe, Asia, and Africa). Here, we present the data on 16 species that are newly reported as components of the flora of five countries or their significant regions (provinces or republics) – five taxa are given for the first time from Poland, and one is rediscovered and thus reassessed, five are new records to Tajikistan, three to Kyrgyzstan, one to Turkey, one to China and one to the Gansu Province in China. The taxa listed below are given alphabetically.

***Achnatherum jacquemontii* (Jaub. & Spach.) P.C. Kuo & S.L. Lu (Poaceae)**

Synonyms: Stipa jacquemontii Jaub. & Spach.; *Lasiagrostis jacquemontii* (Jaub. & Spach.) Munro ex Boiss; *Lasiagrostis jacquemontii* (Jaub. & Spach.) Munro ex Aitch.; *Achnatherum botschantzevii* Tzvel.; *Stipa jacquemontii* Jaub. & Spach. subsp. *chuzomica* Noltie.

Contributors: Marcin Nobis, Ewelina Klichowska

New record

TAJIKISTAN: Kyzylsuu River Valley, Achikalma settl. ca. 24 km ENE of Damburacha, 39°22′9.34″N / 71°38′39.14″E, elevation 2105 m; exp. S-SW, incl. 50–80%, 16 Jul 2021, wp. 1476, *M. Nobis, E. Klichowska s.n.* (KRA 594552-594557, 594559, 594560)

Taxonomic notes

The genus *Achnatherum* in Tajikistan comprises three species so far: *A. caragana*, *A. turkomanicum,* and *A. splendens*. The latter, based on distinct macro- and micromorphological characters, has recently been transferred to the genus *Neotrinia* as *N. splendens* (Trin.) M. Nobis, P.D. Gudkova & A. Nowak (Nobis et al., 2019b).

Newly reported from Tajikistan, *Achnatherum jacquemontii* is well distinguished from all the other above-mentioned taxa from the genus (Figure 1) by having awns 20–35 mm long, clearly unequal lemma and palea, filiform and convolute leaves, culms up to 45 cm long with panicles having short branches (Freitag, 1985; Nobis et al., 2019a).

Distribution and habitat

Achnatherum jacquemontii is a south-central Asian species that occurs in Kyrgyzstan, Uzbekistan, Tajikistan, Afghanistan, Pakistan, Nepal, India, China, and Bhutan (Freitag, 1985; Nobis et al., 2019a, 2020; Wu & Phillips, 2006). In the mountains of Central Asia, *A. jacquemontii* is distributed in Alai and Turkestanian Mts (Nobis et al., 2016), and these are the northernmost localities of the species within its distribution range. In Tajikistan, the species grows on calcareous rocks in the northern part of the country (Figure 1). It is a native species in the flora of Tajikistan and the main component of the *Asperulo oppositifoliae-Achnatheretum jacquemontii* plant associations which occurs in rocky crevices and shelves on steep rocky walls, especially within the rocky breakthroughs of several river valleys. The association was noted in Isfara, Sokh, Kyshtut, Taraty, and Kyzyl-Suu River Valleys in Kyrgyzstan and Tajikistan. Patches of this association were found in the montane and subalpine zones of both the Alai and Turkestan Mts, mainly at the elevation of 1600–2200 m. The association of *Asperulo oppositifoliae-Achnatheretum jacquemontii* develops on shallow alkaline soils in rocky crevices and shelves on different types of calcareous rocks. Within the examined plots, apart from *A. jacquemontii* as a dominant species, *Asperula oppositifolia* and *Nepeta subhastata* have relatively high constancy in the association, as well as some other species typical for rocky substrates in this region and passing from the other associations, belonging to the *Campanuletalia incanescentis* order, e.g., *Campanula incanescens*, *Scutellaria immaculata*, or *Pentanema albertoregelia*. The patches of *Asperulo oppositifoliae-Achnatheretum jacquemontii* are relatively poor in species (Table S1 in the Supplementary material), which is generally typical for chasmophytic vegetation (Nobis et al., 2013; Nowak et al., 2022). The syntaxonomic position of the newly described associations is as follows:

Class: *Asplenietea trichomanis* (Br.-Bl. in Meier & Br.-Bl. 1934) Oberd. 1977

Order: *Campanuletalia incanescentis* M. Nobis, A. Nowak & A. Nobis 2013

Alliance: *Asperulo albiflorae – Poion relaxae* M. Nobis, A. Nowak & A. Nobis 2013

Association: *Asperulo oppositifoliae-Achnatheretum jacquemontii* M. Nobis, Klichowska & A. Nowak 2023, *ass. nov., hoc loco*.

Type relevé (holotypus): Kyrgyzstan, Alai Mts, S of Sytr settl., left slope of Tarty River valley, calcareous rocks, slope 85%, inclination SSE, 39°52′25″N / 71°16′02″E, elev. 2030 m; area of rel. 1.7 m^2, 1 Jul 2016, cover of herb layer 'C' 30%: *Achnatherum jacquemontii* 2, *Artemisia rutifolia* 1, *Asperula oppositifolia* +, *Campanula incanescens* +, *Nepeta subhastata* +, *Pentanema albertoregelia* +, *Spiraea pilosa* +.

***Achnatherum sibiricum* (L.) Keng ex Tzvelev (Poaceae)**

Synonyms: *Avena sibirica* L.; *Stipa sibirica* (L.) Lam.; *Stipa avenoides* Honda; *Achnatherum avenoides* (Honda) Y. L. Chang

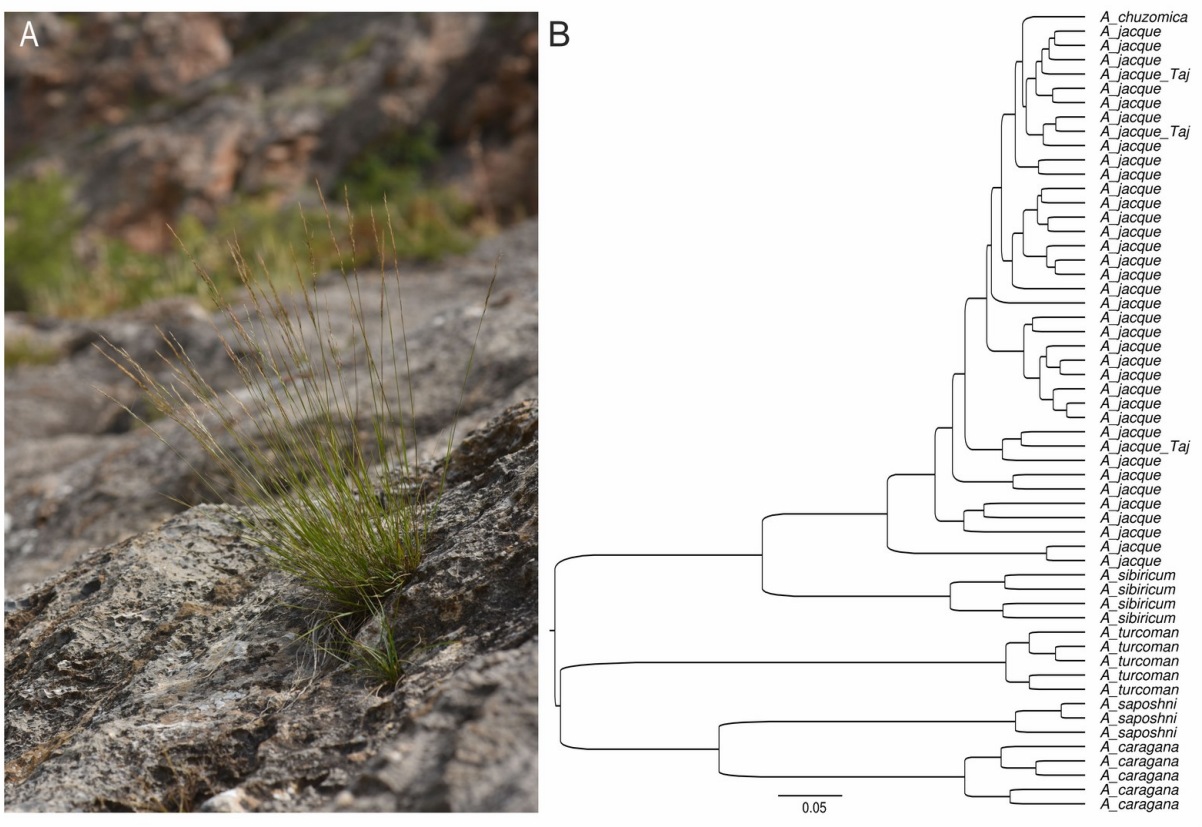

Figure 1 *Achnatherum jacquemontii* (**A**) in Kyzyl-Suu River Valley near Achikalma settl. in Tajikistan (photo. M. Nobis, 2021); (**B**) cluster analysis (UPGMA based on Gower's general similarity coefficient, see Supplementary file) performed on eight quantitative and two qualitative characters of the Central Asian representatives of the genus *Achnatherum*.

Conributors: Marcin Nobis, Agnieszka Nobis

New record

KYRGYZSTAN: Issyk-kul Region, ca. 64 km to the SW from Balykchy (on the W edge of Issyk-Kul Lake), and ca. 23 km to the SW from Kochkor village, near the road A365, near rocks, 41°59′25.72″N / 75°42′58.80″E, elev. 2218 m, wp. 825, 31 Jul 2016, *M. Nobis & A. Nobis* s.n. (KRA 487177, 487178).

Taxonomic notes

The genus *Achnatherum* in Kyrgyzstan is represented by four species: *A. caragana* (Trin.) Nevski, *A. jacquemontii* (syn. *A. botschantzevii* Tzvel.), *A. turcomanicum* (Roshev.) Tzvel. and *A. saposhnikovii* (Roshev.) Nevski (syn. *Timouria saposhnikovii* Roshev.). In the Checklist flora of Kyrgyzstan (Lazkov & Sultanova, 2014) is also cited *A. longiaristatum* (Boiss. et Hausskn.) Roshev. (syn. *Piptatherum longearistatum* Boiss. et Hausskn., *Stipa kurdystanica* Bor), however, this species is endemic for Zagros Mts in Iran and Iraq (Freitag, 1985) and is not a component of Kyrgyz flora. During the field trip in central Tian Shan in 2016, the next species of the genus, *A. sibiricum* was found. The species is somewhat similar to young individuals of *Neotrinia splendens* (Trin.) M. Nobis, P.D. Gudkova & A. Nowak, however, well differs by having longer flowers (7–9 vs. 4–6.5 mm long), longer callus (0.5–0.7 vs. 0.2–0.4 mm long) and maize-like pattern of the lemma epidermis, typical for achnatheroid grasses (Nobis et al., 2019a, 2020; Romaschenko et al., 2012).

Key to the *Achnatherum* species in Kyrgyzstan

1. Awns bigeniculate, sometimes the lower bent weekly visible 2

– Awns straight, flexuous or unigeniculate 3

2. Awn slender, scabrous, 20–35 mm long, floret 4.5–6 mm long, callus 0.3–0.4 mm long, palea 1.5–2 mm shorter than lemma, glumes 5.5–7 mm long, glabrous ... *A. jacquemontii*

– Awn robust, scabrous, 14–20 mm long, floret 6–8 mm long, callus 0.5–0.7 mm long, palea 1–1.5 mm shorter than lemma, glumes 8–10 mm long, shortly pilose only along veins ..... *A. sibiricum*

3. Panicle 2.5–5 cm long, compressed, spike-like, glumes 4–5.5 mm long, floret 2.5–3.5 mm long, awns 2.5–4 mm long ..... *A. saposhnikovii*

– Panicle 10–40 cm long, compressed or open, glumes 4–8 mm long, floret 2.5–4 mm long, awns 4–15 mm long 4

4. Extravaginal shoots present, panicle compressed, awns persistent 10–15 mm long ..... *A. turcomanicum*

– Extravaginal shoots absent, panicle open, awns caducosus 4–13 mm long ..... *A. caragana*

Distribution and habitat

Achnatherum sibiricum is a widely distributed species. Its occurrence is known from the Caucasus throughout northern Central Asia to eastern Siberia (Tzvelev, 1976; Wu & Phillips,

2006). In Central Asia, it is known from Uzbekistan, Kazakhstan, and China. The new locality described here is the southernmost in the region, and the species is native to the Kyrgyz flora. The locality was found in 2015 and confirmed in 2016 (Figure S1 in the Supplementary material) and 2022. Probably, subsequent localities of the species can be found in the region. The population of the species found near the Issyk-Kul Lake consists of several tufts of *A. sibiricum* growing at the bottom of the rocky face of the mountain. The species occurs here together with other representatives of feather grasses, i.e., *Neotrinia splendens*, *Stipa caucasica* subsp. *nikolai* M. Nobis, A. Nobis & A. Nowak, and *S. orientalis* Trin.

***Arrhenatherum elatius* (L.) P. Beauv. ex J. Presl & C. Presl (Poaceae)**

Synonyms: Arrhenatherum americanum P. Beauv., *Arrhenatherum avenaceum* (Scop.) P. Beauv., *Arrhenatherum tuberosum* F.W. Schultz, *Avena avenaceum* (Scop.) P. Beauv., *Avena elata* Salisb., *Avena elata* Forssk., *Avena elatior* L., *Avena tuberosa* Gilib., *Avenastrum elatius* (L.) Jess., *Holcus avenaceus* Scop., *Hordeum avenaceum* Wigg. ex P. Beauv.

Contributors: Marcin Nobis, Marta Krzempek

New records

TAJIKISTAN: Takob, Gissar Range, "Hissar-Darwaz Region A", scrub in the valley of a stream - the right tributary of the Varzob River - near the Upper Varzob botanical station in Kondara - about 40 km to the N of Dushanbe, N 38°48′48″ / E 68°48′20″, elev. 1300 m, 13 Jun 2008, *M. Nobis, M. Kozak, A. Nowak* s.n. (KRA 434235, 435299, 435298); Dushanbe, Karamov Street, "South Tajikistan Region A", Botanical Garden - near the paths, N 38°36′25″ / E 68°46′47″, elev. 880 m, 1 Jun 2007, *M. Nobis* s.n. (KRA 435779).

Taxonomic notes

Arrhenatherum elatius is the only representative of the genus *Arrhenatherum* in Central Asia (Romero-Zarco, 2011; Tzvelev & Probatova, 2019). The species is tetraploid and its basic chromosome number is x = 7; 2n = 4x = 28 (Pfitzenmeyer, 1962; Tzvelev & Probatova, 2019). It is tussock-forming, perennial grass with a long (up to 180 cm), erect, and subcylindrical stem. The plant possesses up to 20 cm long panicles, each with 50 to 100 spikelets.

Arrhenatherum elatius may be misidentified with *A. bulbosum* (Willd.) C. Presl, which grows in Europe, south-west Asia, and northern Africa (Tzvelev & Probatova, 2019) and is characterized by the occurrence of corms (organs of vegetative reproduction) at the base of the stems (Cussans et al., 1993).

Distribution and habitat

Arrhenatherum elatius is a species native to Europe and western Asia (Tzvelev, 1976). Its natural range of distribution reaches 70°N on the Atlantic coast of Norway (Pfitzenmeyer, 1962), its northern limit of occurrence is defined by the −6.5 °C January isotherm, and the eastern limit of its range is the Caucasus (Michalski et al., 2017; Pfitzenmeyer, 1962). Beyond Europe, it occurs in North Africa. It has also been introduced to North America, New Zealand, and Australia (Michalski et al., 2017; Pfitzenmeyer, 1962). The highest altitude at which *A. elatius* has been recorded is 1920 m a.s.l. in Europe, 3000 m a.s.l. in the Caucasus, and 1400–1600 m a.s.l. in Africa (Pfitzenmeyer, 1962).

Arrhenatherum elatius has never been recorded in the mountains of Central Asia in the wild. However, it has been cultivated in experimental fields within this area (Lazkov & Sennikov, 2014; Sidorenko, 1957). Recently, *A. elatius* has been recorded in two locations in Kyrgyzstan: the village of Kök-Say and the northern side of Issyk-Kul Lake. In Kök-Say village, the species is regarded as locally established and not threatening the native vegetation (Lazkov & Sennikov, 2014). In Tajikistan, *A. elatius* has been recorded in the scrub within the noname stream valley near the botanical station in Kondara (Figure S2 in the Supplementary material) as well as along paths in the botanical garden in Dushanbe. In Kondara, the occurrence of the species was confirmed in 2019, and it was classified as an established anthropophyte but not as invasive.

***Asyneuma thomsonii* (Hook.f.) Bornm. (Campanulaceae)**

Synonyms: *Campanula thomsonii* Hook.f.

Contributors: Marcin Nobis, Ewelina Klichowska, Anna Wróbel, Arkadiusz Nowak

New record

KYRGYZSTAN: W Tian-Shan, Talas Ala-Too Range, Talas region, ca. 70 km to the SE of Talas city, near the road M41; shrubs, N 42°03′34″ / E 72°49′07″, elev. 1535 m, 28 Jun 2017, *M. Nobis, E. Klichowska, A. Wróbel, A. Nowak* (KRA 474789, 474787, 476524, 477004).

Taxonomic notes

The genus *Asyneuma* is represented in the flora of Kyrgyzstan by two species: *A. argutum* (Regel) Bornm. (syn.: *A. baldshuanicum* (B.Fedtsch.) Fed.; *A. ramosum* Pavl.; ?*A. debile* Fed.) and *A. attenuatum* (Franch.) Bornm. (syn. *A. trautvetteri* (B.Fedtsch.) Bornm.; *A. strictum* Wendelbo). During field studies in 2017, we found the third new species in the flora of Kyrgyzstan. In the result of comparing the morphological features included in different identification keys (e.g., Damboldt, 1970; Khassanov & Kodirov, 2017; Li, 1987) and revision of the herbarium materials of selected species belonging to the genus *Asyneuma* in LE, AA, TAD, KRA, K, E, we identified the newly found species as *A. thomsonii*. The specimens of the taxon well differ from all the other representatives of the genus in Kyrgyzstan by having glabrous stems, inflorescence branched, flowers loosely distributed (not in cymes distantly separated from each other), lower and middle stem leaves petiolate. *Asyneuma thomsonii* may be misidentified with morphologically similar *A. japonicum* that grows in eastern Asia and differs by having longer stems, longer calyx lobes (6–10 mm long), equal to or somewhat shorter than corolla, and ovate seeds, 0.9–1 mm long × 0.5–0.6 mm wide (Damboldt, 1970; Kozhevnikov, 1996). *Asyneuma thomsonii* is also well differentiated from the three above-mentioned species by molecular data. Based on SNPs derived from DArTseq as well as combined ITS and cpDNA analysis (Supplementary file; Figure 2), the specimens form a well-separated clade. During the revision of the herbarium materials of *Asyneuma* from Kyrgyzstan, we also found several specimens with a set of characters not matching the description neither of *A. argutum* nor *A. thomsonii*. The specimens have lower and middle stem leaves lanceolate to ovate and shortly petiolate (1–2 cm long) and inflorescence with flower organized in cymes distantly separated from each other [specimens examined:

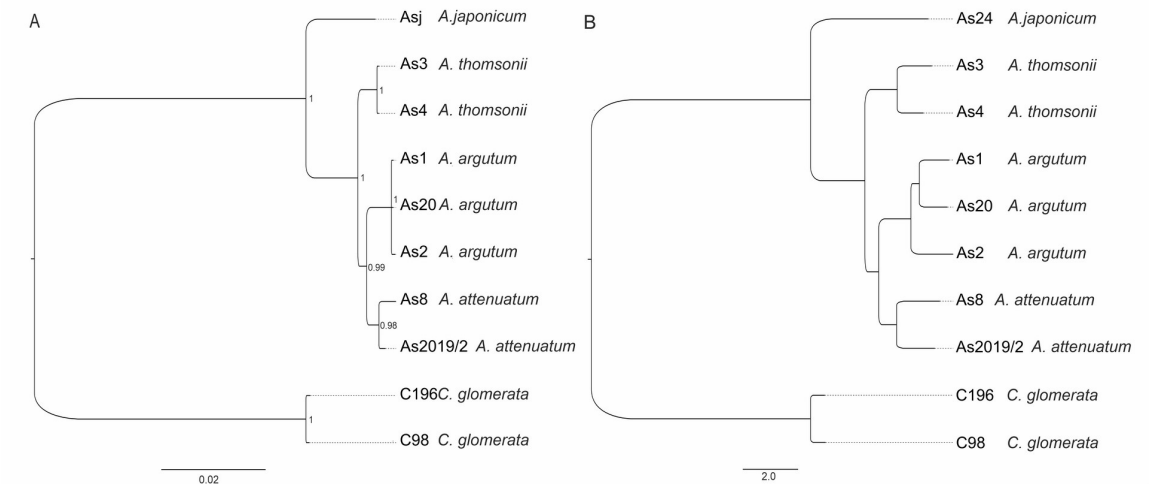

Figure 2 Phylogenetic relationship estimated from (**A**) Neighbor-Joining phylogenetic tree based on Euclidean distance (DArT, 459 SNPs) and (**B**) Bayesian inference of phylogeny (concatenated ITS and cpDNA, 2128 bp). For methods, see Supplementary file.

Ferganskkaya obl. Andizhanskk. u. Aralanbab, 30 May 1899, *D. Litvinov* (LE, 3 sheets); Dolina r. Aflatun (Namanganskago) pri vpadeni r. Yyalma-chaty, 25 Aug 1902, *B. Fedtschenko* (LE 2 sheets); U ozera Sary-Chelek, 22 Jul 1915, *R.I. Roshevitz* (LE)]. It is not excluded that these specimens might be a result of hybridization between *A. thomsonii* and *A. argutum*. However, due to the age of the plant material (the specimens were collected over one hundred years ago), we did not include them in the molecular analyses. The revision of this problematic and morphologically highly variable species group, using tools of integrative taxonomy, is badly needed. It is also worth mentioning that the phylogenetic position of *Asyneuma* as a separate genus is rather doubtful. It is generally clustered within the *Campanula* clade, within the subclade comprising species of *Phyteuma*, *Sergia*, *Cylindrocarpa*, and several species of bellflowers (Jones et al., 2017; Xu & Hong, 2021). Xu and Hong (2021) proposed to merge all of the species of this mentioned above subclade within the common genus *Phyteuma* with the new appropriate circumscription. Nevertheless, taking into account that the phylogenetic relationships between *Campanula* and other genera within *Campanulaceae* are pretty puzzling, it is worth considering a monophyletic approach to the genus and reinclusion of species from such genera as, e.g., *Asyneuma*, *Phyteuma*, *Sergia*, *Cylindrocarpa*, *Petromerula* or *Adenophora* to *Campanula*, just as it was already proposed by Tojibaev et al. (2021) and some other previous authors. Such a broader monophyletic circumscription of *Campanula* (including a number of subgenera and sections) will reflect the close evolutionary relationships in the group and serve the goal of nomenclatural stability within the genus.

Distribution and habitat

Asyneuma thomsonii is a central Asian-mountain species distributed in high mountains of the western Himalayas in India (Kashmir), the Karakorum Mts in Pakistan and Afghanistan, the western Pamir-Alai Mts in Tajikistan and Uzbekistan, as well as the Tian Shan Mts in Kyrgyzstan (Damboldt, 1970; Khassanov & Kodirov, 2017). During field research in 2017 and 2022, the species was found in the Talasski Ala-Too on roadsides and within light shrubs and forests (Figure S3 in the Supplementary material).

Calamagrostis emodensis Griseb. (Poaceae)

Contributors: Beata Paszko, Wen-Li Chen

New records

CHINA. Gansu: Baishuijiang Nature Reserve, Qiujiaba, edge of a forest, elev. 2400–2700 m, [32.899°N, 104.591°E], 5 Sept 2007, *Baishuijiang Team 5660* (PE!); Liujiaping, Qixingoudonghe, under forest, elev. 1756 m, [33.008°N, 104.744°E], 21 Aug 2006, *Baishuijiang Team 2470* (PE!).

Taxonomic notes

Calamagrostis emodensis is a member of the genus *Calamagrostis* Adans. sect. *Calamagrostis* Dumort. which comprises a few closely related groups of taxonomically difficult species (Paszko & Ma, 2011; Tzvelev & Probatova, 2019). In the recent treatment of *Calamagrostis* for China, Lu and Phillips (2006) have defined it very narrowly and recognized six species: *C. emodensis* Griseb., *C. pseudophragmites* (Haller f.) Koeler, *C. hedinii* Pilg., *C. macrolepis* Litv., *C. epigejos* (L.) Roth and *C. kengii* T. F. Wang. Paszko and Ma (2011) revealed that most Chinese collections of *C. epigejos* were incorrectly identified, and most represent *C. extremiorientalis* (Tzvel.) Prob., which is also the older name for *C. kengii*. *Calamagrostis emodensis* (Figure 3) is regarded as a very distinctive species in the section *Calamagrostis,* and it is quite easy to distinguish from the members of the *C. pseudophragmites* complex. It is usually characterized by having a five-veined lemma with a deeply two-toothed apex, awn 5–9 mm arising between teeth, relatively broad leaf blades, a nodding panicle (Figure 3), and its florets containing one stamen with a single plump anther (Bor, 1960; Lu & Phillips, 2006). *Calamagrostis emodensis* differs from *C. pseudophragmites* complex by relative awn insertion on the lemma (exerted between deep teeth above the midpoint versus apical or subapical), longer awns (5.0–8.5 mm versus 1–4 mm), shorter leaf ligules (0.5–4.0 mm versus 2–26 mm) and shorter anthers (0.6–1.1 mm versus 1.0–2.3 mm) (Paszko, 2012). Recently, Paszko (2013) determined the correct taxonomic placement of *Calamagrostis emodensis* var. *breviseta* Hack., which was incorrectly linked

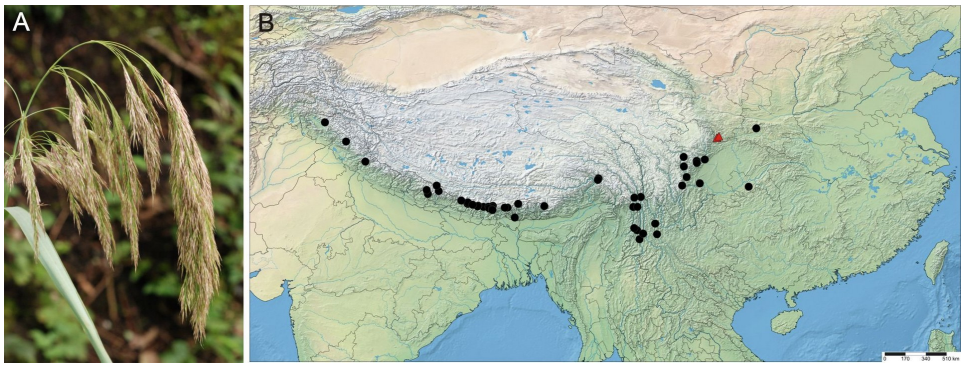

Figure 3 *Calamagrostis emodensis* Griseb. (**A**) Panicle of *C. emodensis*, Mt. Cangshan, Yunnan (China), 24 August 2010. Photo. B. Paszko. (**B**) Distribution map for *C. emodensis* produced using SimpleMappr (http://www.simplemappr.net/). Two new localities in Gansu Province (China) are marked by red triangles. For a list of localities, see Supplementary file.

with *C. emodensis* at the time of description. This variety is conspecific with *C. macrolepis* Litv.

Distribution and habitat

Calamagrostis emodensis extends from the Himalaya Shan through Southwest China (Sichuan, SE Xizang, Yunnan) to central China, Shaanxi, and southern Gansu. It was known hitherto from Nepal, Bhutan, China (Shaanxi, Sichuan, Xizang, Yunnan), India (Himachal Pradesh (disputed area), Jammu & Kashmir (disputed area), Sikkim, Uttarakhand), and Pakistan (Hazara) (Bor, 1960; Cope, 1982; Lu & Phillips, 2006; Noltie, 2000; Press et al., 2000). The first locality of *C. emodensis* has recently been recorded from Kachin State in Northeast Myanmar (Burma) by Paszko (in Nobis et al., 2014). Specimens of *C. garhwalensis* can be misidentified with *C. emodensis*. Here we provide the first two records of *Calamagrostis emodensis* from Wenxian County in southern Gansu Province, North-Central China, where *Calamagrostis emodensis* was collected in the Baishuijiang National Nature Reserve. These localities are located at the northern limit of its geographical range (Figure 3). *Calamagrostis emodensis* is native to the woodlands of Himalayas, southwestern China, and Central China. It is common on landslides in the fir zone, wet cliffs, and stream sides in the mixed broadleaved-pine forests, banks, and gravels by rivers. It grows at an elevation between 1750 and 3660 (−4100) m.

***Calamagrostis obtusata* Trin. (Poaceae)**

Synonyms: *Calamagrostis agrostioides* Matuszk.

Contributors: Beata Paszko, Bing Liu

New records

CHINA. Nei Mongol: Hexigten Banner, Huanggangliang Forest Farm, Dadonggou, Da'etou, under [*Betula platyphylla*] forest, elev. 1720 m, 43.521°N, 117.339°E, 28 Jul 2008, *Chifeng Exped. Team (Y.B. Sun, B. Liu et al. 2-092)* (PE02012002). Shaanxi: [Ningwu Co., Dongzhai Township, Ta keou (between villages Bagouwan and Donglougou), en forêt, 38.862°N, 112.069°E], 9 Jul 1922, *E. Licent 6739* (K, PE00449999, W).

Taxonomic notes

Calamagrostis obtusata is a member of the genus *Calamagrostis* Adans. sect. *Deyeuxia* (Clarion ex P. Beauv.) Dumort., which comprises several closely related groups of taxonomically difficult species, including the species group of *C. obtusata*. This group comprises four close relatives: *C. obtusata* Trin., *C. chalybaea* (Laest.) Fr., *C. pavlovii* Roshev. and *C. krylovii* Reverd. (Tzvelev & Probatova, 2019). In the Flora of China, this group of taxa should be treated in the genus *Deyeuxia* Clarion ex P. Beauv. (Lu & Phillips, 2006). Till now, none of the species from the *C. obtusata* aggregate has been reported from China in the genus *Deyeuxia* (Lu et al., 2006) or *Calamagrostis* (Lu & Phillips, 2006). Recently, several new nomenclatural and taxonomic novelties have been discovered in the genus *Deyeuxia* in China (e.g., Liu & Paszko, 2020; Paszko et al., 2016a, 2016b; Paszko & Soreng, 2013).

Chinese specimens of *Calamagrostis obtusata* were misidentified with *C. stricta* (Timm) Koeler or *C. purpurea* (Trin.) Trin. *Calamagrostis obtusata* differs from *C. stricta* by a lower ratio of callus hairs to lemma length (0.25–0.76 vs. 0.8–1.2), higher ratio palea to lemma length (0.85–1.05 vs. 0.7–0.85), hairy leaf collar (vs. glabrous in *C. stricta*), flat and glabrous upper leaf surface (vs. conspicuously scabrous and covers with high ribs and deep furrows in *C. stricta*) and lower ratio callus hairs to lemma length (0.25–0.76 vs. 0.7–1.2). *Calamagrostis obtusata* differs from *C. purpurea* by the lower ratio of callus hairs to lemma length (0.25–0.76 vs. 0.8–1.2), hairy leaf collar (vs. glabrous in *C. purpurea*), generative culm branching absent (vs. usually present in *C. purpurea*).

Distribution and habitat

Calamagrostis obtusta was described by Trinius (1824) based on a specimen collected in 1818, probably by Ernest Gottfried Haupt (1795–1862), in the vicinity of Tobolsk, a Russian city located in central Siberia. *Calamagrostis obtusata* is an East-European-Siberian species that has a wide distribution in Russia. It occurs from East European Russia through Ural Mts and across Eastern and Western Siberia to Russian Far Eastern regions. Its most southern localities were recorded in Kazakhstan and Mongolia (Gamayunova, 1956; Grubov, 1982; Ivanova, 1990; Tzvelev, 1976). In Kazakhstan, *C. obtusata* grows in its eastern part in the mountains of Altai, Dzungarian Alatau, and Tarbagatay (Gamayunova, 1956), which lie on China–Kazakhstan border. Whereas in Mongolia, it is recorded in its central part, in the Khangai and Khentii Mts (Grubov, 1982).

Here, *Calamagrostis obtusata* is reported as new to China. The first national records are provided from two Chinese provinces, Nei Mongol and Shaanxi (Figure S4 in the Sup-

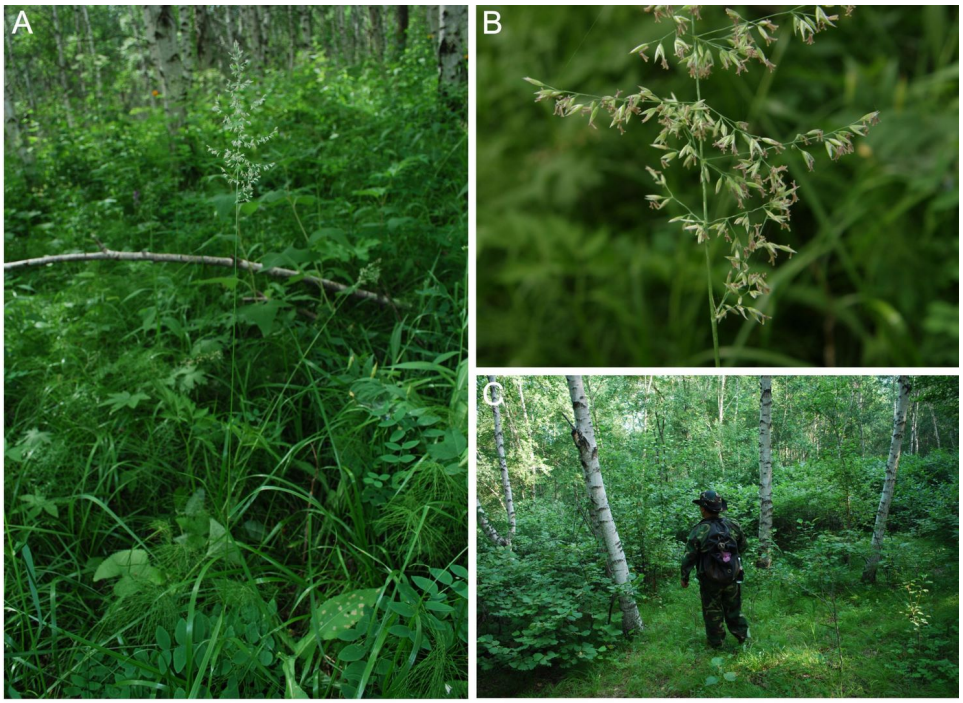

Figure 4 *Calamagrostis obtusata* Trin. and its habitat at the locality in Nei Mongol (China): Hexigten Banner, Huangganglіang Forest Farm, Dadonggou, Da'etou, 11 September 2008 (**A**) Culm of *C. obtusata*; (**B**) panicle of *C. obtusata*; (**C**) *Betula platyphylla* forest. Photo. Bing Liu **(A–C)**.

plementary material). The first more recent collection was made on 28 July 2008 by the Chifeng Expedition Team in the vicinity of Hexigten Qi (Hexigten Banner, Chifeng City, Nei Mongol) in the mixed forest of *Larix principis-rupprechtii* Mayr and *Betula platyphylla* Suk. (Figure 4).

The record from Shaanxi is based on a collection made by Emile Licent (1876–1952) on 9 July 1922 in the forest near Ta keou (between villages Bagouwan and Donglougou, Ningwu Co., Shaanxi), in the area of Luya Shan (Licent, 1924) (*Licent 6739*; K, PE, W) (Figure S4 in the Supplementary material). Licent's collections of vascular plants from China, made between 1914 and 1933, are spread around different herbaria, such as K, P, PE, W, and maybe others too. In most cases, collection labels provide only information about the collection date, collector name, and collection number (especially those housed at the PE herbarium), therefore they can be neglected by scientists. Sometimes information about collection locality provided on the label can be misleading, like in the case of the Kew sheet bearing *Calamagrostis obtusata*. To find or compare a historical locality of Emile Licent with up-to-date state, we used information from Licent's collection's accounts (Licent, 1924, 1936), which cover two decades of his scientific travels. Licent aimed to gather as much material and information as possible, cataloging his travels in two huge volumes. These volumes include travel itineraries, travel journals, maps, and reproductions of photographs taken along the routes, the exact locations of which are indicated on the maps (Manias, 2017; Swanton, 1927). The area of Luya Shan, located in the northeastern corner of the Luliang Mts, provides suitable habitats for *C. obtusata*. Here, conifer forests comprised *Picea* spp. and *Larix* spp. grow with a relatively high cover of 31% (Carpenter, 2018).

***Dittrichia graveolens* (L.) Greuter (Asteraceae)**

Synonyms: *Alunia graveolens* (L.) Lindl., *Erigeron graveolens* L., *Helenium graveolens* (L.) Kuntze, *Inula graveolens* (L.) Desf.

Contributors: Arkadiusz Nowak, Sebastian Świerszcz

New record

TAJIKISTAN: Varzob River Valley in Dushanbe, N 38.49511, E 68.76975, elev. 720–750 m, ruderal vegetation, 09 Oct 2021, *A. Nowak, S. Świerszcz* s.n. (OPUN – Herbarium of Opole University).

Taxonomic notes

The genus *Dittrichia* Greuter is represented by two species, i.e., *Dittrichia viscosa* (L.) Greuter and *Dittrichia graveolens* (L.) Greuter. *Dittrichia graveolens*, first described as *Erigeron graveolens* L., is an erect and densely glandular annual plant (20–70 cm tall). Additionally, *D. graveolens* can be distinguished from *D. viscosa* by shorter ligules (4–7 mm), not or scarcely exceeding the involucre. Among the representatives of the genus *Dittrichia*, only *D. graveolens* has a native occurrence in southwest Asia (Ball, 1976).

Distribution and habitat

Dittrichia graveolens, is a plant of Mediterranean distributional type (Ball, 1976; Brullo & de Marco, 2000). In Central Europe, the rapid expansion of this species has been reported in road verges, particularly motorways (Frajman & Kaligarič, 2009; Király et al., 2014; Kocián, 2015). It has also been introduced in North America, Australia, and South Africa, where it causes significant threats to crops (e.g., Brownsey et al., 2013; Kloot, 1987).

Figure 5 *Dittrichia graveolens* on the roadside in Dushanbe in Tajikistan (photo. A. Nowak, 2021).

During field research in the southern districts of Dushanbe in October 2021, the species was found in road verges of an industrial zone and transportation base in the city outskirts and the sediment ponds of the city's sewage treatment plant (Figure 5). The population is huge, comprising tens of thousands of individuals that form dense vegetation in ruderal habitats. Numerous populations have not been observed on the banks of the Varzob River, but its proximity poses a severe threat to the spread of this invasive species. There is a high probability that seeds of *Dittrichia graveolens* will spread rapidly along the Varzob River, the Kafirnighan River (which flows into it not far from the found location), and further south also along the other river valleys. It is worth noting that floristic surveys conducted in the area of the sewage treatment plant between 2006 and 2010 did not confirm the presence of this species. *Dittrichia graveolens* has rapidly vast overgrown lands of man-made habitats recently. The size of the population proves that the species is an established component in the flora of Tajikistan.

In Dushanbe, the population of *D. graveolens* was accompanied by: *Abutilon theophrasti*, *Alhagi pseudalhagi* subsp. *kirghisorum*, *Amaranthus retroflexus*, *Bromus scoparius*, *B. tectorum*, *Chenopodium strictum*, *Crithopsis delileana*, *Cynodon dactylon*, *Eleusine indica*, *Heliotropium ellipticum*, *Lactuca serriola*, *Medicago orthoceras*, *Parapholis incurva*, *Polygonum paronychioides, Silybum marianum*, *Sisymbrium loeselii*, *Verbascum erianthum* and *Vulpia myuros* (nomenclature of species after POWO, 2022).

***Draba fladnizensis* Wulfen (Brassicaceae)**

Contributors: †Paweł Kauzal, Antoni Zięba, Sławomir Wróbel

New record

POLAND: Western Carpathians – Tatra Mts – High Tatras – Żabi Szczyt Niżni – crevices and rock ledges of the granite wall, exposure: N, elev. ca. 2030 m, EG6029 (ATPOL grid), 21 Jun 2022, *S. Wróbel* s.n. (KRA).

Taxonomic notes

Draba fladnizensis is a tiny perennial white-flower plant forming tufts with a various number of leaf rosettes. Together with a yellow-flower *Draba aizoides* L. and three other white-flower species – *Draba dubia* Suter, *Draba siliquosa* M.Bieb., and *Draba tomentosa* Clairv. (Delimat et al., 2014; Pawłowski, 1956; Ronikier, 2014; Wróbel et al., 2014), *D. fladnizensis* is the fifth species of *Draba* currently noted in the Polish Tatra Mts. *Draba fladnizensis* could be distinguished from other white-flower *Draba* species occurring in the Tatras by characteristic leaves – lacking stellate trichomes, hairless on a surface, and only with straight trichomes on the margins (Figure 6), as well as by a stem – glabrous and typically leafless (Peniašteková & Kliment, 2002).

Distribution and habitat

Draba fladnizensis is a circumpolar plant occurring in the arctic zone of Eurasia and North America. It also grows in higher mountain ranges of the Northern Hemisphere. In Europe, except the polar zone, *Draba fladnizensis* grows in the Scandinavian Mts, the Pyrenees, the Alps, and the Carpathians (Meusel et al., 1965). In the Carpathians, it was detected in a few localities in Romania: the Bucegi Mts – the Southern Carpathians, the Rodna Mts – the Eastern Carpathians (Sârbu et al., 2013), and in Slovakia: the Belianske Tatras – the Western Carpathians (Peniašteková & Kliment, 2002). *Draba fladnizensis* grows in rock crevices, ledges, and screes. This plant occurs predominantly on quartzitic rocks, often dewed with water rich in calcium carbonate, which leaks from higher rocks (Chrtek et al., 1999).

Draba fladnizensis was found in the Polish Tatras by Paweł Kauzal on the 4th of July 2018. It is the first record of this species in Poland. The population described in detail on the 21st of June 2022, consists of 23 tufts, with a few to dozen rosettes, which formed 48 generative shoots in total (Figure 6). The plants are scattered on an area of ca. 50 m^2 in crevices and narrow rock ledges, located at the

Figure 6 *Draba fladnizensis* on Żabi Szczyt Niżni in the Tatra Mts, Poland: (**A**) a tuft of leaf rosettes with blooming shoots; (**B**) leaf rosettes – hairless on a surface and only with straight trichomes on the margins; (**C**) a habitat of crevices and narrow rock ledges located at the lower part of a vertical granite rock wall; (**D**) rock crevices colonized by chasmophytes including tufts of *D. fladnizensis* (photo. S. Wróbel, 2022).

lower part of a vertical granite rock wall. In the vicinity of *Draba fladnizensis*, we detected the following species of vascular plants: *Carex fuliginosa*, *Festuca airoides*, *Lloydia serotina*, *Oxyria digyna*, *Pedicularis verticillata*, *Ranunculus alpestris*, *R. glacialis*, *Saxifraga androsacea*, *S. oppositifolia*, *S. wahlenbergii*, *Silene acaulis* (nomenclature of the species is given after Mirek et al., 2020).

Due to the very small number of mature individuals (<50) of the discovered population and its limited spatial coverage, *Draba fladnizensis* should be considered a critically endangered species (CR) in Poland, according to the D criterion of IUCN Red List Categories (IUCN, 2012).

***Gentiana orbicularis* Schur (Gentianaceae)**

Synonyms: *Gentiana favratii* Rittener, *Gentiana brachyphylla* Vill. subsp. *favratii* (Rittener) Tutin

Contributors: Sławomir Wróbel, Anna Wróbel

New records

POLAND: Western Carpathian Mts, Tatra Mts, Liliowe Turnie (Baniste), elev. 1940 m, exp. NW, alpine grasslands, DG6921 (ATPOL grid), 14 Jun 2022, *S. Wróbel* s.n. (KRA); Western Carpathian Mts, Tatra Mts, Staroroboci ański Wierch, elev. 1970 m, exp. N, alpine grasslands, DG6819 (ATPOL grid), 20 Jun 2022, *S. Wróbel* s.n. (KRA).

Taxonomic notes

According to the latest integrative revision (Hämmerli, 2007), *G. orbicularis* is considered a separate species within *Gentiana* Sect. *Calathianae* Froel. Moreover, it is well-distinguished by its morphology and DNA profile. The species is most similar to *Gentiana verna* L., which is a much more widespread taxon occurring throughout South and Central Europe, on the British Isles, in the Caucasus, arctic Russia and reaching Siberia and Mongolia in the east (Tutin, 1972). In the Carpathians, *G. verna* is most frequently associated with limestone communities (Bertová, 1984; Jasiewicz, 1971).

Both *G. orbicularis* and *G. verna* produce basal leaf rosette; however, they differ in the leaf shape (Hämmerli, 2007; Jasiewicz, 1971; Tutin, 1972). *Gentiana orbicularis* has broadly elliptic, suborbicular, ovate, or obovate rosette leaves that are ca. 1 cm long with more or less rounded apex. On the contrary, *G. verna* has lanceolate to elliptic rosette leaves that are up to 3 cm long with an acute or obtuse apex (Figure 7). Moreover, the longest rosette leaves of *G. orbicularis* are no or little longer than its cauline leaves. On the other hand, the longest rosette leaves of *G. verna* are about twice as long as its cauline leaves. Some resemblance to *G. orbicularis* could also be attributed to *Gentiana brachyphylla* Vill. s.str., a species largely restricted to the Alps, which is well-distinguished by its DNA profile (Hämmerli, 2007).

Due to the phenotypic plasticity observed in *Gentiana* and the novelty of our discovery, we combined morphological identification with DNA barcoding (Figure 7) using ITS1-5.8S-ITS2 marker of nuclear ribosomal DNA (Supplementary file). Our integrative approach clearly supports the identification of the individuals from the Tatra Mts as *G. orbicularis*.

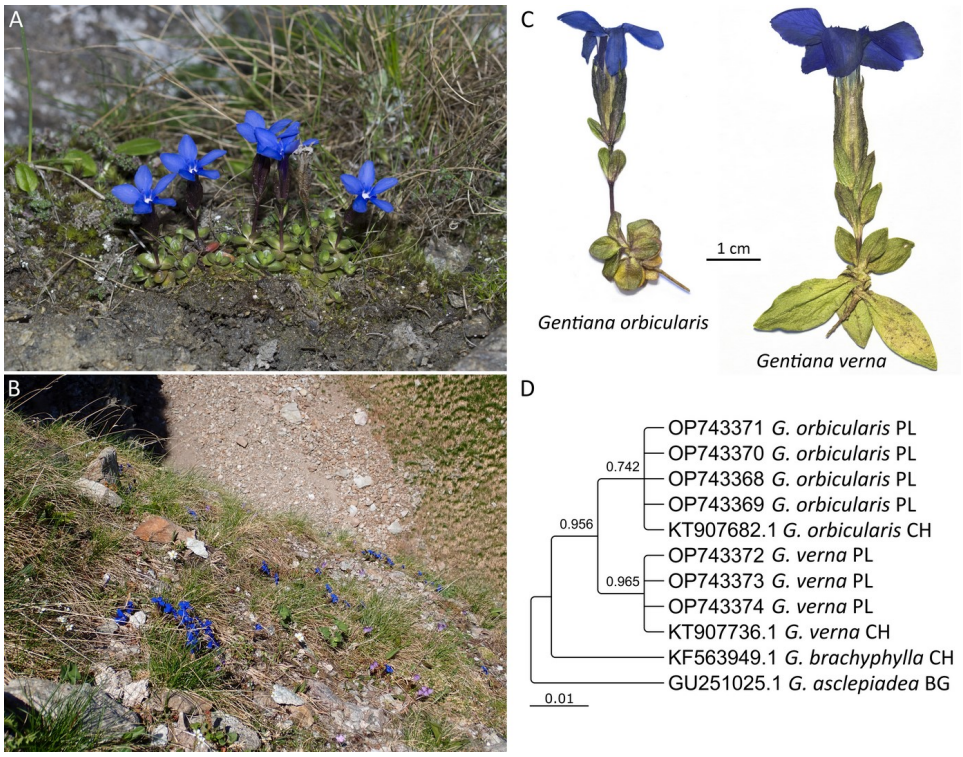

Figure 7 *Gentiana orbicularis* in the Western Tatra Mts, Poland: (**A**) a cluster of vegetative and blooming shoots on Liliowe Turnie; (**B**) habitat – alpine grasslands on Staroroboci̇ański Wierch (photo. S. Wróbel, 2017 and 2022); (**C**) morphological comparison of blooming shoots between *Gentiana orbicularis* and *Gentiana verna*, and (**D**) Maximum-Likelihood tree inferred from ITS1–5.8 S–ITS2 region of nuclear ribosomal DNA (numbers near tree nodes indicate bootstrap support values from 1000 replicates; scale bar indicates the proportion of differences under a General Time Reversible model; the tree was rooted by a sequence of *Gentiana asclepiadea*; abbreviations: PL – Poland, CH – Switzerland, BG – Bulgaria).

Distribution and habitat

Gentiana orbicularis is an alpine species occurring throughout the Alps and in a few isolated localities in the Carpathians (Hämmerli, 2007). In the latter, *G. orbicularis* was observed in the southern part of the range, in the Bucegi Mts, Romania, in sunny places on rocks and skeletal soils in the alpine zone (Beldie, 1967). The species was also reported from one locality in the Western Carpathians, in the Slovakian Belianske Tatra Mts on Predné Jatky Mt. at ca. 2000 m a.s.l. (Bertová, 1984; Fröhner, 1968). However, the origin and current status of this population remain unclear – according to Dostál, *G. orbicularis* presumably appeared in this locality after human-caused introduction (Dostál, 1989).

During the field research on 4 July 2017 in the Western Tatra Mts the species was found in two localities within Tatra National Park, Poland, Liliowe Turnie between 1930–1950 m a.s.l. on a slope with north-western exposure, and Staroroboci̇ański Wierch between 1960–2010 m a.s.l. on a slope with northern exposure. Both localities are situated in the alpine zone on steep slopes where strongly eroded vertical or overhanging rocks occur. *Gentiana orbicularis* grew in the *Festuco versicoloris-Agrostietum alpinae* Pawł., Sokoł. et Wallisch 1928 community established on the mylonite metamorphic rock. In total, the species formed ca. 100 clusters and several hundred blooming shoots. The population sizes were similar, and *G. orbicularis* was scattered throughout the area of ca. 400 m^2 on Liliowe Turnie and ca. 1000 m^2 on Staroroboci̇ański Wierch. In both localities, *G. orbicularis* was accompanied by: *Alchemilla* sp., *Antennaria carpatica*, *Anthoxanthum alpinum*, *Campanula alpina*, *Cardaminopsis neglecta*, *Carex sempervirens*, *Cerastium tatrae*, *Doronicum clusii*, *Festuca airoides*, *F. versicolor*, *Geum reptans*, *Huperzia selago*, *Lloydia serotina*, *Luzula alpino-pilosa*, *Minuartia verna*, *Mutellina purpurea*, *Oreochloa disticha*, *Oxyria digyna*, *Pedicularis oederi*, *Poa alpina*, *Primula minima*, *Ranunculus alpestris*, *Salix reticulata*, *Saxifraga androsacea*, *S. moschata*, *S. oppositifolia*, *S. paniculata*, *Sesleria tatrae*, *Silene acaulis*, *Soldanella carpatica*, *Swertia perennis*, *Veronica aphylla*, and *Viola biflora* (nomenclature of species is given after Mirek et al., 2020).

Due to very restricted distribution and a small number of mature individuals (<250), *G. orbicularis* should be classified as endangered (EN) in Poland according to IUCN 2012 – EN, criterion D (IUCN, 2012). Both populations were monitored in June 2022 and showed no signs of a decline since the first observation in 2017.

***Geranium pyrenaicum* Burm.f. (Geraniaceae)**

Synonyms: *Geranium rotundifolium* var. *grandiflorum* Wahlenb.

Contributors: Arkadiusz Nowak, Sebastian Świerszcz

New record

TAJIKISTAN: Dushanbe, N 38.55641, E 68.79384, ruderal vegetation on tracks and around platforms of the central railway station, elev. 720–780 m, 10 Oct 2021, *A. Nowak*, *S. Świerszcz* s.n. (OPUN).

Figure 8 *Geranium pyrenaicum* in ruderal vegetation near railway tracks in Dushanbe (photo. A. Nowak, 2021).

Taxonomic notes

The genus *Geranium* is represented by 12 species in Tajikistan (Ovchinnikov, 1981). *Geranium pyrenaicum* is a perennial plant with stems 25–70 cm tall. It can be distinguished from *Geranium sibiricum*, which has lanceolate, acute leaf-lobes, and patent hairs on the mericarp, whereas *G. pyrenaicum* has cuneate, truncate leaf-lobes, and adpressed hairs on the mericarp (Webb & Ferguson, 1968).

Distribution and habitat

The native range of *Geranium pyrenaicum* comprises the Mediterranean and sub-Mediterranean regions with Albania, Algeria, Austria, Bulgaria, Corse, Czech Republic, France, Germany, Great Britain, Greece, Hungary, Iran, Ireland, Italy, Crimea, Lebanon-Syria, Morocco, North Caucasus, Portugal, Romania, Sicilia, Spain, Switzerland, Transcaucasia, Tunisia, European part of Turkey, Ukraine, and Yugoslavia (GBIF, 2022; POWO, 2022). The species is also known as being introduced in the Baltic States, Belarus, Belgium, central European part of Russia, Denmark, Finland, the Netherlands, Norway, Poland, Sweden, and West Siberia. It was also noticed in North America (California, Michigan, New York, Vermont, Ontario, Québec), South America (Chile), and Australia (GBIF, 2022; POWO, 2022; Meusel et al., 1978; Seebens et al., 2017).

During the field research on the 10th of October 2021, the species was found along railway tracks and ruderal habitats of storage yards and railway sidings of Dushanbe Main Railway Station (Figure 8). The population size was huge with an uncountable number of individuals. The population occupies bedded areas of railway embankments, roadside verges, and the vicinity of railway platforms. The population certainly comes from materials carried with rail transport. Dushanbe is the central station in Tajikistan, hence the species can be expected to spread rapidly both to southern areas (Kulob, Shartuz) and to west neighboring Uzbekistan.

In Dushanbe, the population of *G. pyrenaicum* was accompanied by: *Abutilon theophrasti*, *Alhagi pseudalhagi* subsp. *kirghisorum*, *Alyssum dasycarpum*, *Arabidopsis thaliana* var. *pusilla*, *Bromus tectorum*, *Cardamine hirsuta*, *Cynodon dactylon*, *Erophila verna*, *Crithopsis delileana, Hordeum murinum* subsp. *leporinum*, *Lactuca serriola*, *Microcephala lamellata*, *Oxalis corniculata*, *Phleum graecum*, *Potentilla indica*, *Sisymbrium loeselii*, *Tribulus terrestris* and *Vulpia myuros* (nomenclature of species after POWO, 2022).

***Helianthus giganteus* L. (Asteraceae)**

Contributors: Marcin Nobis, Agnieszka Nobis

New record

POLAND: Vistula River valley, Połaniec, roadside near the ferry crossing, elev. 162 m, EF29 (ATPOL grid), 26 Sept 2016, *M. Nobis* s.n. (KRA).

Taxonomic notes

The genus *Helianthus* is represented in the flora of Poland by six introduced species (Mirek et al., 2020). Three of them, namely *H. decapetalus* L., *H.* × *laetiflorus* Pers., and *H. tuberosus* L. are established anthropophytes, whereas the remaining species, namely *H. annuus* L., *H. salicifolisus* A. Dietr., and *H. serotinus* Dietr., are cultivated and sporadically escaping from cultivation therefore classified in Poland as ephemerophytes. During the field studies in the Vistula River valley in 2016, we found the next taxon, i.e., *H. giganteus*. The species is well distinguished from all the other *Helianthus* species in Poland by having lanceolate leaves on the stem and involucral bracts adpressed, narrow (1.2–2 mm wide) and acute at the apex (Figure 9; Jäger et al., 2016; Rutkowski, 2017; Schilling, 2006).

Key to the perennial, locally established species of sunflowers occurring in Poland

1. Stems glabrous 2

Figure 9 *Helianthus giganteus* on the roadside in Połaniec (photo. M. Nobis, 2016).

– Stems hairy thought (or at least in the upper half) 3

2. Leaves linear to lanceolate, 0.2–1.2 cm wide, cuneate, (sub-) entire at margin, phyllaries 40–50, linear to lance-linear, 12–20 × 1.8–2 mm (not surpassing discs length), apices long-attenuate ..... *H. salicifolius*

– Leaves lanceolate to ovate, 4–10 cm wide, bases rounded to cuneate, at margins serrate, phyllaries 20–25, lance-linear to lanceolate, 11–16 × 2–3 mm (sometimes leaflike, longest surpassing discs by 1/2+ their lengths) ..... *H. decapetalus*

3. Involucral bracts usually markedly unequal (the outermost shorter than the inner), always closely appressed, leaves lanceolate to lance-ovate, 10–25 × 2–8 cm, bases cuneate ..... *H. × laetiflorus*

– Involucral bracts subequal, loosely appressed or spreading, leaves lanceolate to ovate 4

4. Leaves lanceolate 1.5–3.5 cm wide, shortly petiolate, phyllaries 20–25 (loose or spreading), linear, 1.2–2 mm wide, (margins usually ciliate) apices acute ..... *H. giganteus*

– Leaves wider, lanceolate to ovate, 4–15 cm wide, phyllaries 20–25, lanceolate, 2–4 mm wide, loosely appressed 5

5. Stem rough hairy throughout, phyllaries not surpassing disc diameter ..... *H. tuberosus*

– Stem glabrous, at least in the lower half, phyllaries surpassing disc diameter ..... *H. decapetalus*

Distribution and habitat

Helianthus giganteus is native to the eastern United States and eastern and central Canada (Schilling, 2006). In its natural range, it grows on wet meadows or swamps, often near river banks. The species was introduced to Europe as an ornamental plant, and sometimes it is observed as a locally established anthropophyte (epeco- or rarely agriophyte). In Połaniec, the species population comprised several dozen specimens and grew on the roadside, near the ferry crossing in the Vistula River valley (Figure 9). The status of the species in the flora of Poland requires further studies. However, it can be much more frequent since it can be misidentified with *H. tuberosus* or *H. × laetiflorus*.

***Hieracium piliferum* Hoppe (Asteraceae)**

Contributors: Sławomir Wróbel, Anna Wróbel

New record

POLAND: Western Carpathian Mts, Tatra Mts, High Tatra Mts, Rybi Potok Valley, Miedziane, Szeroki Żleb, acidophilic alpine grassland on the granite rock, elev. ca. 1660 m, exp. SE, EG6017 (ATPOL grid), 27 Jun 2022, *S. Wróbel* s.n. (KRA).

Taxonomic notes

Hieracium piliferum is the only representative of the section *Barbata* Gremli in the Polish flora (Jasiewicz, 1980). In the Tatra Mts, it could primarily be confused with morphologically similar and much widespread *Hieracium alpinum* L., and possibly also with *Hieracium villosum* Jacq. *Hieracium piliferum* has eglandulose leaf margins, whereas *H. alpinum* has glandulose leaf margins. *Hieracium piliferum* forms leafless stems (or with one sessile leaf) ending in a single inflorescence (Figure 10), while *H. villosum* produces stems with numerous amplexicaul cauline leaves and several flower heads (rarely one). The identification key to these species is presented in the work of Szeląg (2001).

Figure 10 *Hieracium piliferum* on the Miedziane Mt., the High Tatra Mts, Poland: (**A**) habitat within acidophilic alpine grasslands in the Szeroki Żleb; (**B**) mature leaf rosettes with blooming shoots (photo. S. Wróbel, 2022).

Distribution and habitat

Hieracium piliferum is a European mountain species with a core distribution area in the Alps. The plant also occurs in isolated localities in other European ranges, including the Pyrenees, the Massif Central, the Dinaric Alps, and the Carpathians (Meusel & Jäger, 1992). In the Southern Carpathians, *H. piliferum* was recorded in the Cernei Mts based on the specimens collected by Rochel at the beginning of the XIX century (Szeląg, 2001). However, the status of this locality remained uncertain (Meusel & Jäger, 1992), and its existence requires verification in the field (Sârbu et al., 2013). In the Western Carpathians, *H. piliferum* was observed only in the High Tatra Mts, within alpine grasslands established on a silicate substrate – in one locality within the Slovakian part of the range in the Valley of Piat Spišských plies, where species was not found afterwards (Szeląg, 2001), and in two localities on the Polish side in the Rybi Potok Valley, first one on the northern slope of the Mięguszowiecki Szczyt Wielki (Pawłowski et al., 1929), while the second one above Morskie Oko lake

(Szeląg, 2001). Despite the attempts to confirm the species occurrence in the Polish Tatra Mts during field research in 2011 and 2012, *H. piliferum* was observed in neither of the previously recorded localities and, therefore, was regarded as extinct (EX or RE) in Poland (Kaźmierczakowa et al., 2016; Szeląg & Delimat, 2014)

On 27 June 2022, *H. piliferum* was rediscovered in the High Tatra Mts, within the Tatra National Park, Poland. The species was found in a new locality in the Rybi Potok Valley, in the Szeroki Żleb on the Miedziane Mt. at ca. 1660 m a.s.l. on the slope with south-eastern exposure. The population consisted of 113 leaf rosettes in total, including 86 rosettes with mature blooming shoots (Figure 10). The individuals were scattered throughout the area of ca. 50 m^2 within acidophilic alpine grasslands surrounded by the mountain pine thickets. The plant community included the species distinctive to the classes *Juncetea trifidi* Hadač in Klika et Hadač 1944 and *Nardo-Callunetea* Prsg 1949, with the admixture of some limestone-related plants. *Hieracium piliferum* was accompanied by: *Agrostis rupestris*, *Antennaria dioica*, *Avenula versicolor*, *Calamagrostis villosa*, *Calluna vulgaris*, *Campanula polymorpha*, *Carex sempervirens*, *Festuca airoides*, *Gentiana asclepiadea*, *Gymnadenia conopsea*, *Hieracium alpinum*, *H. murorum*, *Hypochoeris uniflora*, *Leontodon hispidus*, *L. pseudotaraxaci*, *Nardus stricta*, *Pinus mugo*, *Pulsatilla alba*, *Rhinanthus alpinus*, *Salix silesiaca*, *Solidago alpestris*, *Thesium alpinum*, *Thymus alpestris*, *Vaccinium myrtillus*, *V. vitis-idaea*, and *Veratrum lobelianum* (nomenclature of the species is given after Mirek et al., 2020).

Currently, *H. piliferum* in Poland should be treated as critically endangered (CR) according to criteria B2a and B2b (IUCN, 2012).

Orobanche bartlingii Griseb. (Orobanchaceae)

Contributors: Renata Piwowarczyk, Óscar Sánchez Pedraja

New record

TURKEY: prov. Batum, pr. Mamanat [formerly Mamanati, today Demirciler, Borçka district of Artvin Province in Turkey] ad cacumen m. Moghven, in pratis iter fruticetis, elev. 2900', 15 Jun 1902, *Alexeenko & Woronow* (TGM53196, TGM53198) [as *O. owerinii* by Melikischvili].

Taxonomic notes

The flora of Turkey consists of ca. 39 species of *Orobanche* s.l. (including *Phelipanche* Pomel; Davis et al., 1988; Gilli, 1982; Zare & Dönmez, 2013). However, the distribution of this genus in Turkey is not sufficiently known. *Orobanche alsatica* is a polymorphic aggregate, and comprises parasites of Apiaceae species: *Orobanche alsatica* Kirschl., s. str., parasitize mainly *Peucedanum* sp., such as *Peucedanum cervaria* (L.) Lapeyr., *P. alsaticum* L., while *O. bartlingii* Griseb., parasitize mainly of *Seseli* sp., e.g., *Seseli libanotis* (L.) W.D.J. Koch (syn. *Libanotis pyrenaica* (L.) Bourg.) and *S. transcaucasicum* (Schischk.) Pimenov & Sdobnina (syn. *L. transcaucasica* Schischk.). *Orobanche bartlingii* is morphologically similar and closely related to *O. alsatica*. To the characters that let to distinguished the two taxa belong: corolla (20–25 mm long with regularly and strongly curved dorsal line vs. 12–17 mm long with evenly curved at the base, respectively), style glandular pubescent vs. glabrous or rarely glandular-pubescent, stamens inserted 4–7 mm vs. 1–3 mm above base of the corolla tube (Pujadas Salvà & Gómez García, 2000; Piwowarczyk et al., 2018, 2019). The differences are also clearly observed in seed and pollen micromorphology (Piwowarczyk et al., 2014, 2015), as well as in hosts (*Peucedanum* vs. *Seseli*, respectively). Moreover, molecular analysis of samples of these two species showed that they are in a close relationship, although, ITS tree indicates that these species are clearly separated (Piwowarczyk et al., 2018, 2021).

Distribution and habitat

Orobanche bartlingii is a Eurasian species, occurring from Spain (Pyrenees mountain range), through Central and Eastern Europe and Russia to Siberia, and to Kazakhstan, Kyrgyzstan, and Caucasus (Piwowarczyk et al., 2019; Sánchez Pedraja et al., 2016). During the revision of the herbarium TGM, a new locality of *O. bartlingii* has been found from NE Turkey (Anatolian Peninsula) in the almost Caucasian, Artvin Province, collected in the mountain meadow near the shrubs at ca. 900 m a.s.l. (Figure S5 in the Supplementary material). The species is a new, native taxon to the flora of this country.

Stipa × _balkanabatica_ M. Nobis & P.D. Gudkova (Poaceae)

Contributors: Marcin Nobis, Ewelina Klichowska

New records:

TAJIKISTAN: East Tajikistanian (A subregion), Kyzylsu River Valley, S of Alga settl., ca. 14 km NE of Damburacha, steppe on the hill, 39°19′43.48″N / 71°32′59.91″E, elev. 2077 m, exp. 0- S, incl. 2–10°, 16 Jul 2021, wp. 1480, *M. Nobis, E. Klichowska* s.n. (KRA 594031-594033, 594044-594046, 594057-594061); East Tajikistanian (A subregion), Kyzylsu River Valley, S of Alga settl., ca. 14 km NE of Damburacha, steppe on the hill, 39°19′39.87″N / 71°32′49.04″E, elev. 2102 m, exp. 0- S, incl. 2–15°, 16 Jul 2021, wp. 1480 (200 m to the west), *M. Nobis, E. Klichowska* s.n. (KRA 594862);

KYRGYZSTAN: Naryn Region, Central Tian Shan, ca. 9.5 km W of Naryn, ca. 153 km E of Kazarman, steppe, 11 Jul 2022, elev. 2082 m, 41.437028 N / 75.860948 E, wp 1591, *M. Nobis, E. Klichowska, A. Wróbel* s.n. (KRA)

Taxonomic notes

The species has been recently described from Turkmenistan (Nobis et al., 2020), and it is a result of hybridization between *Stipa sareptana* and *S. caucasica*. *Stipa* × *balkanabatica* is the most similar to *S. consanguinea* Trin. However, it differs well by having more robust, longer (11–15 cm vs. 7–11 cm) awns, longer flowers (10–12 mm vs. 7–9 mm long), longer glumes (32–40 vs. 24–30 mm) as well as the character of vegetative leaves (distinctly scabrous due to densely distributed spinules and prickles vs. glabrous or slightly scabrous due to scattered spinules respectively). However, opposite to typical specimens of *S. balkanabatica*, the specimens found in Tajikistan and Kyrgyzstan have entirely glabrous and smooth vegetative leaves, what is probably a result of the predominance of *S. caucasica* genes. Such specimens with glabrous leaves can be distinguished as ***S.* × *balkanabatica* var. *alaiaensis*** M. Nobis & Klichowska, ***var. nov***. (*diagnose*: from the typical variety differs in having glabrous and smooth, not distinctly scabrous leaves of vegetative shoots; type: Kyzylsu River Valley, S of Alga settl., ca. 14 km NE of Damburacha, steppe on the hill, 39°19′43.48″N / 71°32′59.91″E, elev. 2077 m, exp. 0- S, incl. 2-10°, 16 Jul 2021, wp. 1480, *M. Nobis, E. Klichowska* s.n.; holotype, KRA 594031; isotypes, KRA

Figure 11 *Stipa* × *balkanabatica* var. *alaiaensis* M. Nobis & Klichowska on the steppes in Kyzylsu River Valley, S of Alga settl. in Tajikistan (photo. M. Nobis, 2021).

594032-594033, 594044-594046, 594057-594061; Figure S6 in the Supplementary material).

Distribution and habitats

Stipa × *balkanabatica* var. *alaiaensis* occurs in steppe grasslands, in sunny habitats dominated by grasses. In Tajikistan, it was found on hills within the Kyzyl-Suu River valley (Figure 11), within steppes dominated by *S. caucasica* subsp. *nikolai*, *S. sateptana*, *S. margellanica*, *S. arabica*, *S. hohenackeriana*, *S. lingua*, and others. Whereas in Kyrgyzstan, it grows on the left slope of the Naryn River valley within feathergrass steppes dominated by *S. sareptana*, *S. caucasica* subsp. *nikolai* and *S. macroglossa* subsp. *macroglossa* (nomenclature after Nobis et al., 2020). Probably in both countries, the species is more frequent, and subsequent localities are expected to be found.

***Symphyotrichum cordifolium* (L.) G.L.Nesom (Asteraceae)**

Synonyms: *Aster cordifolius* L.

Contributors – Arkadiusz Nowak, Sylwia Nowak

New records

POLAND: Prószków near Opole - the Arboretum in Pomologia, N 50.592943, E 17.882881, elev. 186 m, CF0560 (ATPOL grid); Zimnice Małe, N 50.57001, E 17.928786, elev. 180 m, CF0584 (ATPOL grid); Opole - Wójtowa Wieś, N 50.646459, E 17.925321, CF0503 (ATPOL grid); 5 Oct 2022, *A. Nowak*, *S. Nowak* s.n. (OPUN, KRA).

Taxonomic notes

Symphyotrichum cordifolium was first described as *Aster cordifolius* L. The species belongs to the sect. *Symphyotrichum* and subsect. *Heterophylli*, which includes ten taxa native to North America (Brouillet et al., 2006), one of which (*Symphyotrichum laeve* (L.) Á. Löve & D. Löve) is known in Poland (Euro+Med, 2006). *Symphyotrichum cordifolium* is a colonial and cespitose plant with basal and proximal leaf bases usually deeply cordate and leaf margins usually sharply or coarsely serrate. Additionally, *Symphyotrichum cordifolium* has heads (20–300+) in densely paniculiform arrays, involucres cylindro-campanulate to cylindric, and ray laminae (5–)6–8(–10) × 1.4–1.8 mm (Brouillet et al., 2006).

Distribution and habitat

The native range of *Symphyotrichum cordifolium* comprises the eastern states of USA and southeast Canada (POWO, 2022). According to GBIF (2022), the species was introduced to Norway, Great Britain, the Netherlands, Bavaria in Germany, Sweden, and New Zeeland. It was also assessed as a neophyte plant in the Czech Republic (Pyšek et al., 2012). In Poland, the species is known as a cultivated plant but has never been recorded in natural habitats.

A huge population of the species was found in the naturalistic park of the former Royal Pomological Academy in Prószków near Opole in October 2022. Its size is uncountable and certainly much larger than years ago, when the species was not noticed (Figure 12). *Symphyotrichum cordifolium* most likely appeared in the Prószków arboretum at the time when the horticultural institute was operating there. Perhaps the plant was acclimatized here for ornamental purposes. However, in the last 30 years, despite very frequent visits by botanists from the Opole University, it has never been spotted in the wild part of the park. Currently, the species occupies almost the entire forest floor and outcompetes even strong competitors that tightly cover the undergrowth, such as *Hedera helix*. In addition, two smaller species populations were found in oak-hornbeam and riparian stands in Zimnice Małe and Opole-Wójtowa Wieś. As both localities are located in the Oder River valley, there is a high risk of the species spreading along the river.

In Prószków, the population of *S. cordifolium* was accompanied by *Carpinus betulus*, *Quercus robur*, *Q. petraea*, *Robinia pseudoacacia* in the tree layer, *Cornus sanguinea*, *Corylus avel-*

Figure 12 *Symphyotrichum cordifolium* (**A**) in the naturalistic park (**B**) of the former Royal Pomological Academy in Prószków (photos: A. Nowak (A) and M. Nobis (B) 2022).

lana, *Euonymus europaeus* in the shrub layer and *Aegopodium podagraria*, *Carex sylvatica*, *Galanthus nivalis*, *Geranium robertianum*, *Hedera helix*, *Impatiens noli-tangere, Lamium album*, *L. galeobdolon*, *L. maculatum*, *Maianthemum bifolium*, *Milium effusum*, *Poa nemoralis*, *Pulmonaria obscura* in the herb layer (nomenclature of species after Euro+Med, 2006).

***Thalictrum alpinum* L. (Ranunculaceae)**

Contributors: Sławomir Wróbel, Anna Wróbel

New record

POLAND: Western Carpathian Mts, Tatra Mts, Mała Łąka Valley, Niżnia Świstówka, slope under Mnichowe Turnie, elev. ca. 1620 m, exp. W, snowbed (*Salicetum retuso-reticulatae*) and alpine grasslands (*Seslerion tatrae*) communities on limestone, DG5977 (ATPOL grid), 21 Jul 2022, *S. Wróbel* s.n. (KRA).

Taxonomic notes

Thalictrum alpinum is a small, glabrous plant reaching up to 15 cm high, making it the smallest representative of the genus *Thalictrum* in the Tatra Mts. Two other species, *Thalictrum minus* L. and *Thalictrum aquilegiifolium* L. are much taller. Moreover, *T. alpinum* produces only basal 2-ternate leaves, without stipels, and forms sparse flowers organized in a simple raceme inflorescence (Figure 13). On the other hand, *T. minus* and *T. aquilegiifolium* produce cauline leaves and form compound inflorescences (Pawłowski, 1956; Tutin et al., 1964). Based on these morphological characters, *T. alpinum* is well-distinguished from other *Thalictrum* species occurring in the Tatra Mts.

Distribution and habitat

Thalictrum alpinum is a circumboreal species occurring in northern Eurasia, Alaska, northern Canada, and Greenland, as well as in isolated localities in the mountain regions southwards (Meusel et al., 1965). The species grows in the tundra biome, on rocky habitats and moraines near glaciers, within alpine grasslands, dry alpine meadows, fens, and mires (Newskij, 1937). In Europe, the species is currently observed in the arctic and subarctic zone as well as in mountain ranges: the Sierra Nevada, the Pyrenees, the Alps, the Dinaric Alps, the Carpathians, and in the Caucasus (Meusel et al., 1965). In the Carpathians, *T. alpinum* was noted in the southern part of the range on several localities between 1500–2250 m a.s.l. in the Bucegi Mts, Romania (Beldie, 1967), while XIX-century records from the eastern part (Rodna Mts and the Ceahlău Massif, Romania) were not confirmed later (Dihoru & Negrean, 2009). In Poland, the species was reported as a fossil component of the Pleistocene flora – fruits of *T. alpinum* were found in the sediments dated back to the North Polish Glaciation, collected in multiple localities in Poland, including Grel near Nowy Targ, ca. 26 km northwards of the Tatra Mts (Kucowa, 1985), which is the closest locality to the record described here.

During the field research on 21 July 2022 in the Western Tatra Mts, the species was found in one locality within the Tatra National Park, Poland – in the upper part of the Mała Łąka Valley, in the Niżnia Świstówka, on a slope with western exposure at ca. 1620 m a.s.l. under a limestone rock wall (Figure 13). The shoots of *T. alpinum* were scattered throughout the area of ca. 100 m^2 in two different phytocenoses – within snowbed community *Salicetum retuso-reticulatae* Br.-Bl. 1926 under the rock wall while further downwards of the wall within limestone alpine grasslands of *Seslerion tatrae* Pawł. 1935. The size of the population was estimated at several hundred individuals in total, with high occurrence frequency in both habitat types. However, only 36 plants formed generative shoots. Moreover, fruit-bearing specimens were restricted exclusively to the snowbed habitat, while in alpine grassland communities, only vegetative shoots appeared. In the middle of the locality, the Braun-Blanquet phytosociological plot was established – on 25 July 2022, 25 m^2, elev. 1620 m, exp. W, incl. 45°, herbaceous plant coverage in layer C – 90%, mosses coverage in layer D – 80%, number of herbaceous plant species – 27: *Salix reticulata* 4, *Carex firma* 2, *Dryas octopetala* 2, *Pedicularis oederi* 2, *Swertia perennis* 2, *Anthoxanthum alpinum* 1, *Bartsia alpina* 1, *Carex sempervirens* subsp. *tatrorum* 1, *Helianthemum nummularium* subsp. *grandiflorum* 1, *Saxifraga moschata* 1, *Thalictrum alpinum* 1, *Campanula polymorpha* +, *Cerastium tatrae* +, *Crepis jacquinii* +, *Minuartia verna* +, *Parnassia palustris* +, *Picea abies* +, *Pinguicula alpina* +, *Poa alpina* +, *Polygonum viviparum* +,

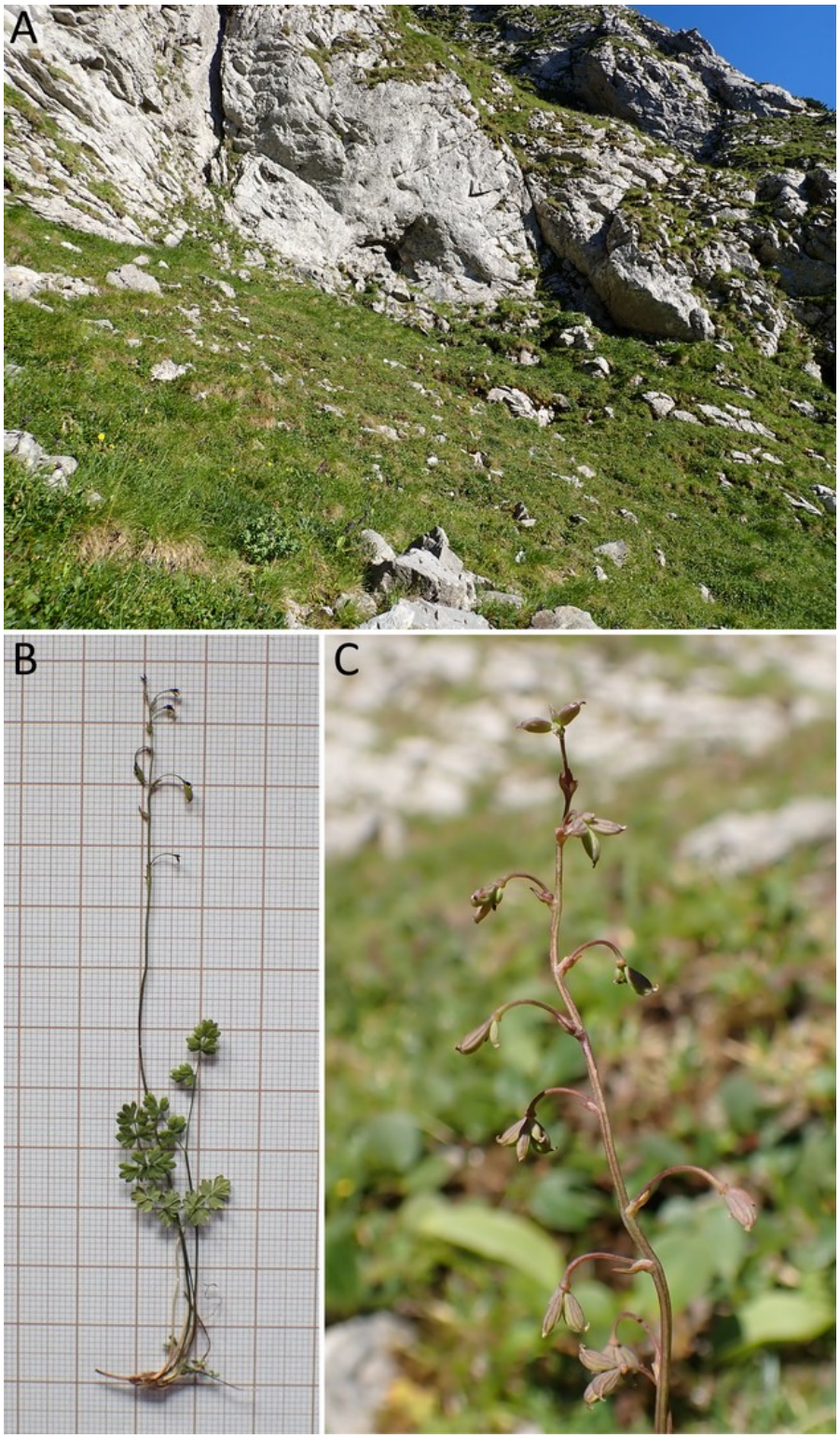

Figure 13 *Thalictrum alpinum* in the Niżnia Świstówka in the Western Tatra Mts, Poland: (**A**) habitat under limestone rock wall; (**B**) generative shoot; (**C**) simple raceme fruit-bearing inflorescence (photo. S. Wróbel, 2022).

Ranunculus alpestris +, *Saxifraga aizoides* +, *S. paniculata* +, *Scabiosa lucida* +, *Selaginella selaginoides* +, *Tofieldia calyculata* +, *Trisetum alpestre* + (nomenclature of the species is given after Mirek et al., 2020).

The described locality of *T. alpinum* is the first in the Tatra Mts and the first contemporary observation of the plant throughout the Western Carpathians and in Poland. Due to very restricted distribution and a small number of mature individuals (<50), *T. alpinum* should be regarded as critically endangered (CR) in both the Western Carpathians and Poland according to IUCN 2012 – CR, criterion D (IUCN, 2012).

Supplementary material

The following supplementary material is available for this article:

Supplementary File. The source data.

Acknowledgments

We would like to thank Prof. Philippe Küpfer (University of Neuchâtel, Switzerland) for confirming our morphological identification of *Gentiana orbicularis* from the Tatra Mts.

Beata Paszko is grateful to the Curators of BM, E, GOET, K, KRAM, KUN, LE, M, MICH, P, PE and US for loans of their collections.

This paper is dedicated to the memory of Paweł Kauzal, an employee of the Tatra National Park, our friend, died before his time.

References

Araújo, M. B., & Rahbek, C. (2006). How does climate change affect biodiversity? *Science*, *313*(5792), 1396–1397.

Ball, P. W. (1976). *Dittrichia* W. Greuter. In T. G. Tutin, V. H. Heywood, N. A. Burges, D. H. Valentine, S. M. Walters, & D. A. Webb (Eds.), *Flora Europaea* (Vol. 4, pp. 136–137). Cambridge University Press.

Beldie, A. (1967). *Flora și vegetația munților Bucegi*. Editura Academiei Române.

Bellard, C., Bertelsmeier, C., Leadley, P., Thuiller, W., & Courchamp, F. (2012). Impacts of climate change on the future of biodiversity. *Ecology Letters*, *15*(4), 365–377.

Bertová, L. (1984). *Gentiana* L. In L. Bertová (Ed.), *Flóra Slovenska* (Vol. 4(1), pp. 101–120). Veda, vydavateľstvo Slovenskej akadémie vied.

Bor, N. L. (1960). *Grasses of Burma, Ceylon, India and Pakistan (excluding Bambuseae)*. Pergamon Press.

Brouillet, L., Semple, J. C., Allen, G. A., Chambers, K., & Sundburg, S. (2006). *Symphyotrichum* Nees. In Flora North America Editorial Committee (Eds.), *Flora of North America. Vol. 20. Asteraceae, Part 2. Astereae and Senecioneae* (pp. 465–539). Oxford University Press.

Brownsey, R., Kyser, G. B., & DiTomaso, J. M. (2013). Stinkwort is rapidly expanding its range in California. *California Agriculture*, *67*, 110–115. https://doi.org/10.3733/ca.v067n02p110

Brullo, S., & de Marco, G. (2000). Taxonomical revision of the genus *Dittrichia* (Asteraceae). *Portugaliae Acta Biologica*, *19*, 341–354.

Bulakh, E. V., Shevera, M. V., Szkudlarz, P., Bulakh, P. Y., & Celka, Z. (2022). Identification of new taxa of *Portulaca oleracea* L. aggregate from Poland based on seed coat micromorphological characteristics. *Acta Societatis Botanicorum Poloniae*, *91*, Article 9118. https://doi.org/10.5586/asbp.9118

Carpenter, C. (2018). *Temperate broadleaf and mixed forests*. Southern Asia: China. World Wildlife Fund (WWF). Accessed January, 2023, from https://www.worldwildlife.org/ecoregions/pa04

Chrtek, J., Kochjarová, J., & Feráková, V. (1999). *Draba fladnizensis* Wulfen. In J. Čeřovský, V. Feráková, J. Holub, Š. Maglocký, & F. Procházka (Eds.), *Červená Kniha ohrozených a vzácnych druhov rastlin a živočichov SR a ČR, 5. Vyššie rastliny* (p. 135). Priroda a.s.

Cope, T. A. (1982). Calamagrostis Adanson. In E. Nasir & S. I. Ali (Eds.), *Flora of Pakistan No. 143. Poaceae* (pp. 481–491). Herbarium Royal Botanical Gardens.

Cussans, J. W., Morton, A. J., & Khan, A. U. (1993). An ecological comparison of weed and non-weed forms of *Arrhenatherum elatius* (L.) Beauv. ex J. & C. Presl. In *Proc. of the Brighton Crop Protection Conference on Weeds* (pp. 515–522).

Damboldt, J. (1970). Revision der Gattung *Asyneuma*. *Boissiera*, *17*, 1–128.

Davis, P. H., Mill, R. R., & Tan, K. (Eds.). (1988). *Flora of Turkey and the East Aegean Islands* (Suppl. 1) (Vol. 10, pp. 200–201). Edinburgh University Press.

Delimat, A., Borucki, T., & Mirek, Z. (2014). *Draba siliquosa* M. Bieb. Głodek karyntyjski. In R. Kaźmierczakowa, K. Zarzycki, & Z. Mirek (Eds.), *Polska Czerwona Księga Roślin. Paprotniki i rośliny kwiatowe* (3rd ed., pp. 217–219). Instytut Ochrony Przyrody Polskiej Akademii Nauk.

Dihoru, G., & Negrean, G. (2009). *Carte roșie a plantelor vasculare din România*. Editura Academiei Române.

Dostál, J. (1989). *Nova Kvetena ČSR*. Československá akademie věd.

Dudáš, M., Ďurišová, Ľ., Eliáš, P., Jr., Eliášová, M., Kobiv, Y., Kšiňan, S., Pliszko, A., & Taraška, V. (2022). New floristic records from Central Europe 10 (reports 134–148). *Thaiszia*, *32*(2), 179–192. https://doi.org/10.33542/TJB2022-2-05

Ellis, L., Afonina, O., Czernyadjeva, I., Alegro, A., Šegota, V., Boiko, M., Burghardt, M., Alataş, M., Aslan, G., Batan, N., Dragićević, S., Erata, H., Kırmacı, M., Özenoğlu, H., Evangelista, M., Valente, E., Feletti, T., Ezer, T., Fedosov, V. E., … Winter, G. (2022). New national and regional bryophyte records, 69. *Journal of Bryology*, *44*(1), 87–102. https://doi.org/10.1080/03736687.2022.2061242

Euro+Med. (2006). *Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity*. Retrieved December 13, 2022, from http://ww2.bgbm.org/EuroPlusMed/

Frajman, B., & Kaligarič, M. (2009). *Dittrichia graveolens*, nova tujerodna vrsta slovenske flore. *Hladnikia*, *24*, 35–43.

Freitag, H. (1985). The genus *Stipa* (Gramineae) in southwest and south Asia. *Notes from the Royal Botanical Garden, Edinburgh*, *42*, 355–489.

Fröhner, S. (1968). Floristische Neuheiten aus der Hohen und Belaer Tatra (1965). *Preslia*, *40*, 417–426.

Gamayunova, A. P. (1956). Calamagrostis Adans. In N. V. Pavlov (Ed.), *Flora of Kazakhstan* (Vol. 1, pp. 181–188). Academy of Sciences of the Kazakh SSR (in Russian).

Gaujour, E., Amiaud, B., Mignolet, C., & Plantureux, S. (2012). Factors and processes affecting plant biodiversity in permanent grasslands. A review. *Agronomy for Sustainable Development*, *32*(1), 133–160.

GBIF. (2022). *Global Biodiversity Information Facility*. Retrieved December 13, 2022, from http://www.gbif.org/

Gilli, A. (1982). Orobanchaceae L. In P. H. Davis (Ed.), *Flora of Turkey and the East Aegean Islands* (Vol. 7, pp. 1–23). Edinburgh University Press.

Grubov, V. I. (1982). *Opredelitel sosudistykh rastenij Mongolii (s atlasom)* [Key to the vascular plants of Mongolia (with an atlas)]. Nauka.

Hämmerli, M. (2007). *Molecular aspects in systematics of Gentiana Sect. Calathianae Froel*. University of Neuchâtel.

IUCN. (2012). *IUCN red list categories and criteria: Version 3.1* (2nd ed.). Accessed January, 2023, from https://www.iucnredlist.org/resources/categories-and-criteria

Ivanova, E. V. (1990). *Calamagrostis* Adanson. In L. I. Malyschev & G. A. Peschkova (Eds.), *Flora Sibiri. Poaceae (Gramineae)* (Vol. 2, pp. 92–103). Nauka, Sibirskoe Otdelenie (in Russian).

Jäger, E. J., Ebel, F., Hanelt, P., & Müller, G. K. (Eds.). (2016). *Rothmaler-Exkursionsflora von Deutschland: Krautige Zier-und Nutzpflanzen*. Springer-Verlag.

Jasiewicz, A. (1971). *Gentiana* L., Goryczka. In B. Pawłowski & A. Jasiewicz (Eds.), *Flora Polska. Rośliny Naczyniowe Polski i Ziem Ościennych* (Vol. 12, pp. 8–32). Państwowe Wydawnictwo Naukowe.

Jasiewicz, A. (1980). *Hieracium* L., Jastrzębiec. In A. Jasiewicz (Ed.), *Flora Polska. Rośliny Naczyniowe Polski i Ziem Ościennych* (Vol. 14, pp. 199–335). Państwowe Wydawnictwo Naukowe.

Jones, K. E., Korotkova, N., Petersen, J., Henning, T., Borsch, T., & Kilian, N. (2017). Dynamic diversification history with rate upshifts in Holarctic bell-flowers (*Campanula* and allies). *Cladistics*, *33*(6), 637–666. https://doi.org/10.1111/cla.12187

Kaźmierczakowa, R., Bloch-Orłowska, J., Celka, Z., Cwener, A., Dajdok, Z., Michalska-Hajduk, D., Pawlikowski, P., Szczęśniak, E., & Ziarnek, K. (2016). *Polska czerwona lista paprotników i roślin kwiatowych. Polish red list of pteridophytes and flowering plants*. Instytut Ochrony Przyrody Polskiej Akademii Nauk.

Khassanov, F., & Kodirov, U. H. (2017). *Campanulaceae*. In A. N. Sennikov (Ed.), *Flora of Uzbekistan* (Vol. 2, pp. 135–153). Navroz'z Publishers.

Király, G., Eliáš, P., Jr., & Dítě, D. (2014). Two thermophilic alien species new to the flora of Slovakia. *Thaiszia Journal of Botany*, *24*(2), 125–134.

Kloot, P. M. (1987). The naturalised flora of South Australia 1. The documentation of its development. *Journal of the Adelaide Botanic Gardens*, *10*(1), 81–90.

Kocián, P. (2015). *Dittrichia graveolens* (L.) Greuter – a new alien species in Poland. *Acta Musei Silesiae, Scientiae Naturales*, *64*, 193–197. https://doi.org/10.1515/cszma-2015-0027

Kozhevnikov, A. E. (1996). Campanulaceae. In V. Y. Barkalov (Ed.), *Plante Vasculares Orientalis Extremi Sovietici*. Nauka.

Kucowa, I. (1985). *Thalictrum* L., Rutewka. In A. Jasiewicz (Ed.), *Flora Polski. Rośliny Naczyniowe* (Vol. 4, pp. 87–90). Państwowe Wydawnictwo Naukowe.

Lazkov, G., & Sennikov, A. (2014). New records in vascular plants alien to Kyrgyzstan. *Biodiversity Data Journal*, *2*, Article e1018. https://doi.org/10.3897/BDJ.2.e1018

Lazkov, G. A., & Sultanova, B. A. (2014). *Checklist of vascular plants of Kyrgyzstan*. United Nations Development Programme (in Russian).

Li, A. D. (1987). Campanulaceae. In T. A. Adylov (Ed.), *Conspectus Florae Asiae Mediae*. Academiae Scientarum UzSSR.

Licent, E. (1924). *Hoang ho-Pai ho: Comptes rendus de dix années, 1914–1923, de séjour et d'exploration dans le bassin du Fleuve Jaune, du Pai Ho, et des autres tributaires du golfe du Pei Tcheu Ly.* 1 atlas (Vol. 3). Librairie française.

Licent, E. (1936). *Hoang ho-Pai ho: Comptes-rendus de onze années, 1923–1933, de séjour et d'exploration dans les Bassin du Fleuve Jaune, du Pai ho et des autres tributaries du golfe du Pei Tcheu ly.* 1 atlas (Vol. 3). Librairie française.

Liu, B., & Paszko, B. (2020). *Calamagrostis hongii* (Poaceae: Agrostidinae), a new species from southwestern China. *Phytokeys*, *166*, 41–55. https://doi.org/10.3897/phytokeys.161.53010

Lu, S. L., Chen, W. L., & Phillips, S. M. (2006). *Deyeuxia* Clarion ex P. Beauvois. In Z. Y. Wu, P. H. Raven, & D. Y. Hong (Eds.), *Flora of China. Vol.* 22. *Poaceae* (pp. 348–359). Science Press.

Lu, S. L., & Phillips, S. M. (2006). *Calamagrostis* Adans. In Z. Y. Wu, P. H. Raven, & D. Y. Hong (Eds.), *Flora of China. Vol.* 22. *Poaceae* (pp. 359–361). Science Press.

Manias, C. (2017). Jesuit Scientists and Mongolian fossils: The French paleontological missions in China, 1923–1928. *Isis*, *108*(2), 307–332.

Meusel, H., & Jäger, E. (1992). *Vergleichende Chorologie der Zentraleuropäischen Flora* (Vol. 3). Gustav Fischer Verlag.

Meusel, H., Jäger, E., Rauschert, S., & Weinert, E. (1978). *Vergleichende chorologie der Zentraleuropäischen Flora* (Vol. 2). Jena, Gustav Fischer Verlag.

Meusel, H., Jäger, E., & Weinert, E. (1965). *Vergleichende Chorologie der Zentraleuropäischen Flora* (Vol. 1). VEB Gustav Fischer Verlag.

Michalski, S. G., Malyshev, A. V., & Kreyling, J. (2017). Trait variation in response to varying winter temperatures, diversity patterns and signatures of selection along the latitudinal distribution of the widespread grassland plant *Arrhenatherum elatius*. *Ecology and Evolution*, *7*(9), 3268–3280. https://doi.org/10.1002/ece3.2936

Mirek, Z., Piękoś-Mirkowa, H., Zając, A., & Zając, M. (2020). *Vascular plants of Poland: An annotated checklist*. W. Szafer Institute of Botany, Polish Academy of Sciences.

Newskij, S. A. (1937). *Thalictrum* L. In B. K. Sziszkin (Ed.), *Flora SSSR* (Vol. 7, p. 519). Izdatelstwo Akademii Nauk SSSR.

Nobis, M., Domina, G., Meço, M., Mullaj, A., Bazan, G., Ebel, A. L., Király, G., Erst, A., Nowak, A., Sukhorukov, A. P., Pospelova, E. B., Pospelov, I. N., Vasjukov, V. M., Piwowarczyk, R., Seregin, A. P., Király, A., Kushunina, M., Liu, B., Molnár, A. V., … Xiang, K. (2018). Contribution to the flora of Asian and European countries: New national and regional vascular plant records, 7. *Botany Letters*, *165*(2), 200–222. https://doi.org/10.1080/23818107.2017.1415817

Nobis, M., Ebel, A. L., Nowak, A., Turginov, O. T., Kupriyanov, A. N., Nobis, A., Olonova, M. V., Paszko, B., Piwowarczyk, R., Chen, W. L., Gudkova, P. D., Klichowska, E., Nowak, S., & Pujadas-Salvà, A. J. (2014). Contribution to the flora of Asian and European countries: New national and regional vascular plant records, 2. *Acta Botanica Gallica: Botany Letters*, *161*(2), 209–221. https://doi.org/10.1080/12538078.2014.921643

Nobis, M., Gudkova, P., Nowak, A., Sawicki, J., & Nobis, A. (2020). A synopsis of the genus Stipa (Poaceae) in Middle Asia, including a key to species identification, an

annotated checklist, and phytogeographic analyses. *Annals of the Missouri Botanical Garden*, *105*(1), 1–63. https://doi.org/10.3417/2019378

Nobis, M., Gudkova, P. D., & Nowak, A. (2019a). *Neotrinia splendens* gen. nov. and *Pennatherum* sect. nov. in *Achnatherum* (Poaceae: Stipaeae). *Turczaninowia*, *22*(1), 37–41. https://doi.org/10.14258/turczaninowia.22.1.5

Nobis, M., Gudkova, P. D., & Pendry, C. (2019b). Synopsis of the tribe Stipeae (Poaceae) in Nepal. *PhytoKeys*, *128*, 97–119. https://doi.org/10.3897/phytokeys.128.34637

Nobis, M., Klichowska, E., Terlević, A., Wróbel, A., Erst, A., Hrivnák, R., Ebel, A. L., Tikhomirov, V. N., Byalt, V. V., Gudkova, P. D., Király, G., Kipriyanova, L. M., Olonova, M., Piwowarczyk, R., Pliszko, A., Rosadziński, S., Seregin, A. P., Honcharenko, V., Marciniuk, J., … Zykova, E. Y. (2019c). Contribution to the flora of Asian and European countries: New national and regional vascular plant records, 8. *Botany Letters*, *166*(2), 163–188. https://doi.org/10.1080/23818107.2019.1600165

Nobis, M., Nowak, A., & Nobis, A. (2013). *Stipa zeravshanica* sp. nov. (Poaceae), an endemic species from rocky walls of the western Pamir Alai Mountains (middle Asia). *Nordic Journal of Botany*, *31*(6), 666–675. https://doi.org/10.1111/j.1756-1051.2013.00184.x

Nobis, M., Nowak, A., Piwowarczyk, R., Ebel, A. L., Király, G., Kushunina, M., Sukhorukov, A. P., Chernova, O. D., Kipriyanova, L. M., Paszko, B., Seregin, A. P., Zalewska-Gałosz, J., Denysenko, M., Nejfeld, P., Stebel, A., & Gudkova, P. D. (2016). Contribution to the flora of Asian and European countries: New national and regional vascular plant records, 5. *Botany Letters*, *163*(2), 159–174. https://doi.org/10.1080/23818107.2016.1165145

Noltie, H. J. (2000). *Flora of Bhutan. Vol. 3, Part 2. The Grasses of Bhutan*. Royal Botanic Garden Edinburgh & Royal Government of Bhutan.

Nowak, A., Świerszcz, S., Nowak, S., Plasek, V., Nobis, A., Klichowska, E., & Nobis, M. (2022). Diversity, distribution, and classification of chasmophytic vegetation in the Central Asian Biodiversity Hotspot: Alpine belt of the Eastern Pamir-Alai and Western Tian Shan Mountains. *Acta Societatis Botanicorum Poloniae*, *91*, Article 911. https://doi.org/10.5586/asbp.911

Ovchinnikov, P. N. (Ed.). (1981). *Flora of the Tajik SSR, Vol. 6. Fabaceae (genus* Astragalus*) – Cynomoriaceae*. Nauka.

Paszko, B. (2012). *Calamagrostis gamblei* sp. nov. (Poaceae) from the western Himalayas, NW India. *Polish Botanical Journal*, *57*(2), 327–334.

Paszko, B. (2013). The identity of *Calamagrostis emodensis* var. *breviseta* (Poaceae, Agrostidinae). *Phytotaxa*, *118*, 35–42. https://doi.org/10.11646/phytotaxa.118.2.2

Paszko, B., Chen, W. L., & Liu, B. (2016a). Confirmation of *Calamagrostis salina* in China, previously misidentified as *C. macilenta*, and notes about *C. kokonorica* and *C. macilenta* (Poaceae, Agrostidinae). *Phytotaxa*, *268*(4), 251–262. https://doi.org/10.11646/phytotaxa.268.4.3

Paszko, B., Chen, W. L., & Liu, B. (2016b). *Calamagrostis altaica*, a neglected species of the Chinese Flora, and note on *C. korotkyi* (Poaceae, Agrostidinae). *Phytotaxa*, *286*(4), 256–266. http://dx.doi.org/10.11646/phytotaxa.286.4.4

Paszko, B., & Ma, H. Y. (2011). Taxonomic revision of the *Calamagrostis epigeios* complex with particular reference to China. *Journal of Systematics and Evolution*, *49*, 495–504. https://doi.org/10.1111/j.1759-6831.2011.00140.x

Paszko, B., & Soreng, R. J. (2013). Species delimitation and name application in *Deyeuxia abnormis*, *Agrostis zenkeri*, *A. pleiophylla* and related taxa (Poaceae: Agrostidinae). *Phytotaxa*, *111*, 1–26. https://doi.org/10.11646/phytotaxa.111.1.1

Pawłowski, B. (1956). *Flora Tatr. Rośliny naczyniowe* (Tom. I). Polska Akademia Nauk, Państwowe Wydawnictwo Naukowe.

Pawłowski, B., Sokołowski, M., & Wallisch, K. (1929). Zespoły roślinne i flora doliny Morskiego Oka. *Rozprawy Wydziału Matematyczno-Przyrodniczego Polskiej Akademii Umiejętności*, *67*(Dz. A/B 1927), 171–304.

Peniašteková, M., & Kliment, J. (2002). *Draba* L., Chudôbka. In V. Feráková (Ed.), *Flóra Slovenska* (Vol. V(4), pp. 500–528). Veda, vydavateľstvo Slovenskej akadémie vied.

Pfitzenmeyer, C. D. C. (1962). *Arrhenatherum elatius* (L.) J. & C. Presl. *Journal of Ecology*, *50*, 235–245.

Piwowarczyk, R., Denysenko-Bennett, M., Góralski, G., Kwolek, D., Sánchez Pedraja, Ó., Mizia, P., Cygan, M., & Joachimiak, A. J. (2018). Phylogenetic relationships within *Orobanche* and *Phelipanche* (Orobanchaceae) from Central Europe, focused on problematic aggregates, taxonomy, and host ranges. *Acta Biologica Cracoviensia Series Botanica*, *60*(1), 45–64. https://doi.org/10.24425/118044

Piwowarczyk, R., Halamski, A. T., & Durska, E. (2014). Seed and pollen morphology in the *Orobanche alsatica* complex (Orobanchaceae) from central Europe and its taxonomic significance. *Australian Systematic Botany*, *27*(2), 145–157. https://doi.org/10.1071/SB14013

Piwowarczyk, R., Madeja, J., & Nobis, M. (2015). Pollen morphology of the Central European broomrapes (Orobanchaceae: *Orobanche*, *Phelipanche* and *Orobanchella*) and its taxonomical implications. *Plant Systematics and Evolution*, *301*, 795–808. https://doi.org/10.1007/s00606-014-1117-6

Piwowarczyk, R., Sánchez Pedraja, Ó., Moreno Moral, G., Fayvush, G., Zakaryan, N., Kartashyan, N., & Aleksanyan, A. (2019). Holoparasitic Orobanchaceae (*Cistanche*, *Diphelypaea*, *Orobanche*, *Phelipanche*) in Armenia: Distribution, habitats, host range and taxonomic problems. *Phytotaxa*, *386*(1), 1–106. https://doi.org/10.11646/phytotaxa.386.1.1

Piwowarczyk, R., Schneider, A. C., Góralski, G., Kwolek, D., Denysenko-Bennett, M., Burda, A., Ruraż, K., Joachimiak, A. J., & Sánchez Pedraja, O. (2021). Phylogeny and historical biogeography analysis supports Caucasian and Mediterranean centres of origin of key holoparasitic Orobancheae (Orobanchaceae) lineages. *PhytoKeys*, *174*, 165–194. https://doi.org/10.3897/phytokeys.174.62524

POWO. (2022). *Plants of the World Online*. Retrieved December 13, 2022, from http://www.plantsoftheworldonline.org/

Press, J. R., Shrestha, K. K., & Sutton, D. A. (2000). *Annotated checklist of the flowering Plants of Nepal*. Natural History Museum.

Pujadas Salvà, A. J., & Gómez García, D. (2000). *Orobanche montserratii* A. Pujadas & D. Gómez (Orobanchaceae), especie nueva del Pirineo oscense. *Anales del Jardín Botánico de Madrid*, *57*, 267–275.

Pyšek, P., Danihelka, J., Sádlo, J., Chrtek, J., Chytrý, M., Jarošík, V., Kaplan, Z., Krahulec, F., Moravcová, L., Pergl, J., Štajerová, K., & Tichy, L. (2012). Catalogue of alien plants of the Czech Republic (2nd edition): checklist update, taxonomic diversity and invasion patterns. *Preslia*, *84*(2), 155–255.

Raab-Straube von, E., & Raus, T. (2022). Euro+ Med-Checklist Notulae, 15. *Willdenowia*, *52*(2), 273–299. https://doi.org/10.3372/wi.52.52205

Romaschenko, K., Peterson, P. M., Soreng, R. J., Garcia-Jacas, N., Futorna, O., & Susanna, A. (2012). Systematics and evolution of the needle grasses (Poaceae: Pooideae: Stipeae) based on analysis of multiple chloroplast loci, ITS, and lemma micromorphology. *Taxon*, *61*, 18–44. https://doi.org/10.1002/tax.611002

Romero-Zarco, C. (2011). *Helictochloa* Romero Zarco (Poaceae), a new genus of oat grass. *Candollea*, *66*, 87–103. https://doi.org/10.15553/c2011v661a6

Ronikier, M. (2014). *Draba tomentosa* Clairv. Głodek kutnerowaty. In R. Kaźmierczakowa, K. Zarzycki, & Z. Mirek (Eds.), *Polska Czerwona Księga Roślin. Paprotniki i rośliny kwiatowe* (3rd ed., pp. 222–223). Instytut Ochrony Przyrody Polskiej Akademii Nauk.

Rutkowski, L. (2017). *Klucz do oznaczania roślin naczyniowych Polski niżowej*. Wydawnictwo Naukowe PWN.

Sánchez Pedraja, Ó., Moreno Moral, G., Carlón, L., Piwowarczyk, R., Laínz, M., & Schneeweiss, G. M. (2016). [continuously updated] *Index of Orobanchaceae*. Accessed October, 2016, from http://www.farmalierganes.com/Otrospdf/publica/Orobanchaceae%20Index.htm [Liérganes, Cantabria, Spain]

Sârbu, I., Ştefan, N., & Oprea, A. (2013). *Plante Vasculare din România. Determinator ilustrat de teren*. Victor B Victor.

Schilling, E. E. (2006). *Helianthus giganteus*. In Flora of North America Editorial Committee (Eds.), *Flora of North America* (Vol. 21). Missouri Botanical Garden & Harvard University Herbaria.

Seebens, H., Blackburn, T. M., Dyer, E. E., Genovesi, P., Hulme, P. E., Jeschke, J. M., Pagad, S., Pyšek, P., Winter, M., Arianoutsou, M., Bacher, S., Blasius, B., Brundu, G., Capinha, C., Celesti-Grapow, L., Dawson, W., Dullinger, S., Fuentes, N., Jäger, H., … Essl, F. (2017). No saturation in the accumulation of alien species worldwide. *Nature Communications*, *8*(2), Article 14435. https://doi.org/10.1038/ncomms14435

Sidorenko, G. T. (1957). *Arrenatherum*. In P. N. Ovchinnikov (Ed.), *Flora of Tajik SSR* (Vol. 1, pp. 352–353). Izdat. Akademii Nauk SSSR.

Swanton, J. R. (1927). Rev. of *Dix Années (1914-1923) dans le Bassin du Fleuve jaune et Autres Tributaires du Golfe du Pei tcheu ly*, by Emile Licent. *American Anthropologist New Series*, *29*(1), 120–124. http://dx.doi.org/10.1525/aa.1927.29.1.02a00190

Szeląg, Z. (2001). *Hieracium piliferum* (Asteraceae) in the Carpathian Mountains. *Polish Botanical Journal*, *45*(2), 151–153.

Szeląg, Z., & Delimat, A. (2014). *Hieracium piliferum* Hoppe. Jastrzębiec włosisty. In R. Kaźmierczakowa, K. Zarzycki, & Z. Mirek (Eds.), *Polska Czerwona Księga Roślin. Paprotniki i rośliny kwiatowe* (3rd ed., pp. 552–553). Instytut Ochrony Przyrody Polskiej Akademii Nauk.

Tlałka, D., Sliwinska, E., & Kruk, J. (2021). *Polystichum setiferum* at the northeastern limit of its distribution range. *Acta Societatis Botanicorum Poloniae*, *90*, Article 902. https://doi.org/10.5586/asbp.902

Tojibaev, K., Sennikov, A., Lazkov, G. A., Jang, C., Choi, H.-J., Chang, K. S., Jung, S.-Y., Kim, A., & Choi, K. (2021). *Checklist of vascular plants of the Tian-Shan Mountain System*. Korea National Arboretum.

Trinius, C. B. (1824). *De Graminibus Unifloris et Sesquifloris*. Impenis Academiae Imperialis scientiarum. https://doi.org/10.5962/bhl.title.15650

Tutin, T. G. (1972). *Gentiana* L. In T. G. Tutin, W. H. Heywood, N. A. Burges, D. M. Moore, D. H. Valentine, S. M. Walters, & D. A. Webb (Eds.), *Flora Europaea* (Vol. 3, pp. 59–63). Cambridge University Press.

Tutin, T. G., Heywood, V. H., Burges, N. A., Valentine, D. H., Walters, S. M., & Webb, D. A. (1964). *Flora Europaea. Vol. 1. Lycopodiaceae to Platanaceae* (Vol. 1, p. i-xxxii, 1–464). Cambridge University Press.

Tzvelev, N. N. (1976). *Zlaki SSSR* [Grasses of the USSR] (p. 788). Nauka Publishers.

Tzvelev, N. N., & Probatova, N. S. (2019). *Grasses of Russia* (p. 646). KMK Scientific Press.

Verkhozina, A. V., Anisimov, A. V., Beshko, N. Y., Biryukov, R. Y., Bondareva, V. V., Chernykh, D. V., Dorofeev, N. V., Dorofeyev, V. I., Ebel, A. L., Efremov, A. N., Erst, A. S., Esanov, H. K., Esina, I. G., Fateryga, A. V., Fateryga, V. V., Fomenko, V. A., Gamova, N. S., Gaziev, A. D., Glazunov, V. A., … Krivenko, D. A. (2022). Findings to the flora of Russia and adjacent countries: New national and regional vascular plant records, 4. *Botanica Pacifica*, *11*(1), 129–157. https://doi.org/10.17581/bp.2022.11114

Webb, D. A., & Ferguson, I. K. (1968). *Geranium* L. In V. H. Heywood, N. A. Burges, D. H. Valentine, S. M. Walters, & D. A. Webb (Eds.), *Flora Europaea* (Vol. 2, pp. 193–199). Cambridge University Press.

Wróbel, S., Delimat, A., & Ronikier, M. (2014). *Draba dubia* Suter. Głodek mroźny. In R. Kaźmierczakowa, K. Zarzycki, & Z. Mirek (Eds.), *Polska Czerwona Księga Roślin. Paprotniki i rośliny kwiatowe* (3rd ed., pp. 220–221). Instytut Ochrony Przyrody Polskiej Akademii Nauk.

Wu, Z. L., & Phillips, S. M. (2006). Tribe Stipeae. In Z. Y. Wu, P. H. Raven, & D. Y. Hong (Eds.), *Flora of China, Vol. 22 (Poaceae)* (pp. 188–212). Science Press & Missouri Botanical Garden Press.

Xu, C., & Hong, D. Y. (2021). Phylogenetic analyses confirm polyphyly of the genus *Campanula* (Campanulaceae s. str.), leading to a proposal for generic reappraisal. *Journal of Systematics and Evolution*, *59*(3), 475–489. https://doi.org/10.1111/JSE.12586

Zare, G., & Dönmez, A. A. (2013). Two new records of the genus *Orobanche* (Orobanchaceae) from Turkey. *Turkish Journal of Botany*, *37*(3), 597–603. https://doi.org/10.3906/bot-1205-44