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A new find of *Arabidopsis neglecta* (*Brassicaceae*) in the Svydovets Massif (Ukrainian Carpathians)

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Abstract. A new population of the Pancarpathian endemic species *Arabidopsis neglecta* was discovered in the Svydovets Massif at Komyn in 2018. It is the fifth population known so far for the Svydovets. A short description of the subalpine-alpine scree habitat (*Rumici scutati-Rhodioletum roseae*) is given. Many of the co-occuring species are listed in the *Red Data Book of Ukraine* (2009); however, *A. neglecta* is not included in the current edition of the *Red Data Book of Ukraine*. Though, its micropopulations on steep slopes of glacial cirques are highly vulnerable due to climate change and some other factors.
Keywords: *Cardaminopsis neglecta*, Carpathian Biosphere Reserve, floristic record, rare species, Ukraine

Пахшвьоль К., Пахшвьоль Т. **Нова знахідка *Arabidopsis neglecta* (*Brassicaceae*) на території масиву Свидовець (Українські Карпати)**. *Український ботанічний журнал*, 2019, 76(1): 60–66.

Реферат. Нова популяція карпатського ендеміка *Arabidopsis neglecta* була виявлена на г. Комин на території Свидовецького масиву Карпатського біосферного заповідника в 2018 р. Це п'ята популяція цього виду, виявлена на даний час в межах масиву Свидовець. Подано стислий опис субальпійсько-альпійського оселища (*Rumici scutati-Rhodioletum roseae*) на щебнистому схилі. На відміну від *A. neglecta*, більшість видів цього угруповання включені в Червону книгу України (2009). Відмічено, що мікропопуляції даного виду на крутих схилах гляціальної арени перебувають під значною загрозою через зміни клімату.
Ключові слова: Карпатський біосферний заповідник, рідкісний вид, флористична знахідка, Україна, *Cardaminopsis neglecta*

Introduction

Arabidopsis neglecta (Schult.) O'Kane & Al-Shehbaz (= *Cardaminopsis neglecta* (Schult.) Hayek, *Arabis neglecta* Schult.) is a Pancarpathian endemic species occurring in Poland, Slovakia, Romania and Ukraine (Marhold, 2011; Hurdu et al., 2012; Kliment et al., 2016). It grows in subalpine to alpine screes of intermediate to siliceous bedrock like sandstone flysch and crystalline schists (Sychowa, 1985; Chopyk, Fedoronchuk, 2015; Bartók et al., 2016). For the Ukrainian Carpathians, it has been considered as "Vulnerable" (VU) and "Data Deficient" (DD) by Malinovski et al. (2002), or even as "Endangered" (EN) by Kricsfalusy and Budnikov (2007), but has not been included later in the 3rd edition of the *Red Data Book of Ukraine* (Chervona knyha..., 2009). As pointed out by Kobiv (2011, 2017, 2018), this perennial, short-lived glareophyte is definitely a rare and threatened mountain species of the Ukrainian Carpathians where it occurs in the following mountain ranges: Chornohora, Svydovets, Marmarosh, and Chyvchyny Mts. (Kotov, 1953; Malinovski et al., 2002; Bedei, 2006; Chopyk, Fedoronchuk, 2015; Novikoff, Hurdu, 2015).

In the Svydovets Massif, only four populations have been known so far (Fig. 1). The first one can be found in a famous glacial cirque (c. 48°13′08″ N, 24°14′17″ E) below Mt. Blyznytsia Velyka and Mt. Blyznytsia Mala that is part of the Carpathian Biosphere Reserve and harbours several rare high-mountain species, such as *Antennaria carpatica* (Wahlenb.) Bluff & Fingerh., *Hedysarum hedysaroides* (L.) Schinz & Thell, *Veronica alpina* L., *Erigeron alpinus* and *Oreochloa disticha* (Wulfen) Link; the latter two are considered extinct at this locality (Klášterský, 1929; Domin, 1930; Kobiv, 2017). The second population was reported from Mt. Drahobrat (c. 48°14′04″N, 24°13′58″E) by Margittai (1935: 89); it

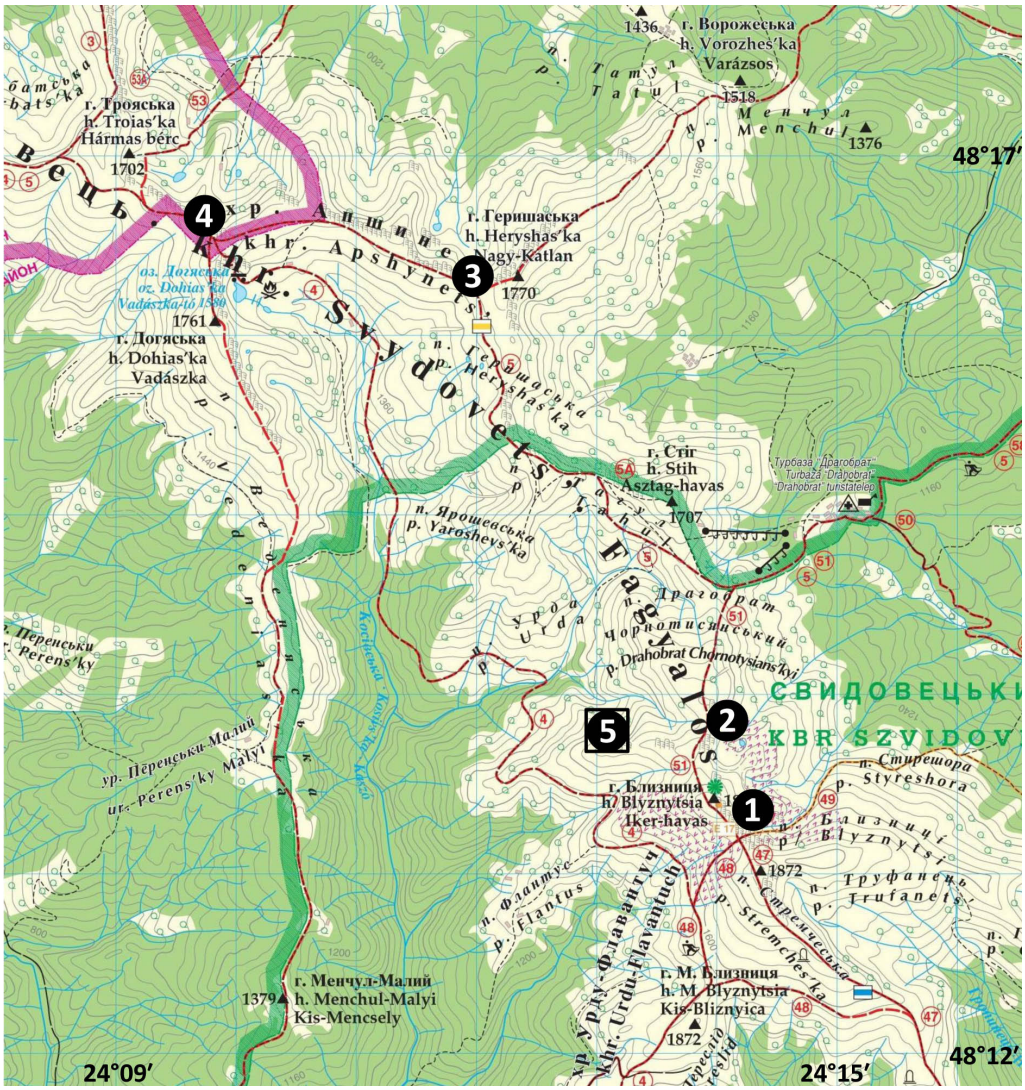

Fig. 1. Distribution of *Arabidopsis neglecta* in the Svydovets Massif (Ukrainian Carpathians). Populations 1–5 according to the text. The newly discovered population no. 5 at Komyn is emphasized with a black square. Green line: boundary of the Carpathian Biosphere Reserve. Purple Line: boundary of the districts Rakhiv and Tiachiv. Modified from: A Máramarosi-havasok turistatérképe, 2. Kiadás, 1 : 50 000, Kárpátia Térképműhely Ktf. 2008

lies within a part of the Carpathian Biosphere Reserve but is now unconfirmed. The third one was reported also by Margittai (1935: 89) for Mt. Gereshaska [Heryshas'ka] (c. 48°16′17″N, 24°12′06″E) and could be considered confirmed by Chopyk (herbarium voucher in KW). The fourth locality at Mt. Trojaska/polonyna Apshynets (48°16′38.7″N, 24°09′36.5″E, 1640 m a.s.l., NE-exposed) was discovered only recently by Kobiv et al. (2009) and is very close to the previous one; see also Kobiv (2011) for population characterization.

Material and methods

During botanical fieldwork in the Svydovets Massif, a new population of *Arabidopsis neglecta* was discovered in a cirque at Komyn, c. 1.2 km NW of the summit of Mt. Blyznytsia Velyka (no. 5 in Fig. 1). There, a handful of fruiting and vegetative individuals were growing in a scree microsite of a steep NW-exposed cliff. Due to the rarity of the species, we refrained from collecting herbarium specimens but documented its occurrence with photographs. The identification of *A. neglecta* was later confirmed with literature (Kotov, 1953; Jávorka,

Fig. 2. Habitat of *Arabidopsis neglecta* at Komyn (Svydovets Massif, Ukrainian Carpathians) where this species grows at the bottom of a steep cliff surrounded by *Alnus alnobetula* (*A. viridis*). Photo by Clemens Pachschwöll, 22 August 2018

Csapody, 1979; Sychowa, 1985; Chopyk, Fedoronchuk, 2015) and by a specialist. GPS coordinates (WGS84) with an accuracy of c. 5 m as well as the altitude were determined with a Holux M-241 GPS logger. If not stated otherwise, nomenclature and taxonomy of taxa mentioned in this paper follow Euro+Med (2006–).

Results and discussion

Location, ecological characteristics and status of the newly discovered population of *Arabidopsis neglecta* in the Svydovets Massif

In the following, we present the exact location, ecological characteristics and accompanying species, see also Fig. 1–3.

Arabidopsis neglecta: Ukraine, Zakarpatska Oblast, Rakhiv Raion (District), Svydovets Massif, Carpathian Biosphere Reserve, north-exposed cirque at Komyn c. 1.2 km NW of Mt. Blyznytsia Velyka peak, 48°13′40.4″N, 24°13′01.4″E, 1670 m a.s.l.

Habitat (see Fig. 2): bottom of a steep (c. 70°), NW-exposed cliff of calcium-containing flysch surrounded by shrubs of *Alnus alnobetula* (Ehrh.) K. Koch (= *A. viridis* (Chaix) DC.). It harbours stairlike, densely vegetated outcrops as well as also poorly vegetated microsites.

Accompanying species: *Achillea oxyloba* subsp. *schurii* (Sch. Bip.) Heimerl, *Asplenium viride* Huds., *Calamagrostis villosa* (Chaix) J.-F. Gmel., *Campanula kladniana* (Schur) Witasek, *Cerastium alpinum* L., *Doronicum columnae* subsp. *carpaticum* (Griseb. & Schenk) Soó (= *D. carpaticum* (Griseb. & Schenk) Nyman, see Pachschwöll, 2014), *Festuca amethystina* subsp. *orientalis* Krajina (= *F. inarmata* Schur), *Galium anisophyllon* Vill., *Parnassia palustris* L., *Phyteuma orbiculare* L., *Primula elatior* (L.) L. (incl. *Primula poloninensis* (Domin) Fed.), *Rhodiola rosea* L., *Rumex scutatus* L., *Saussurea alpina* (L.) DC., *Sabulina verna* (L.) Rchb. (= *Minuartia verna* (L.) Hiern., incl. *M. gerardii* (Willd.) Hayek and *M. pauciflora* (Kit. ex Kanitz) Dvořaková, see Fedoronchuk & Mosyakin, 2016), *Saxifraga paniculata* Cav., *Selaginella selaginoides* (L.) Schrank & Mart., *Thymus pulcherrimus* Schur, *Viola biflora* L. and others.

Obs.: Clemens Pachschwöll & Tetiana Pachschwöll, 22 August 2018; ref. (on digital images): Filip Kolář, 17 September 2018.

Fig. 3. *Arabidopsis neglecta*: close-up of a fruiting individual. Photo by Clemens Pachschwöll, 22 August 2018

Arabidsopis neglecta grows here in scree microsites of the association *Rumici scutati-Rhodioletum roseae* Malinovsky et al. 1991 from alliance *Papavero-Thymion pulcherrimi* I. Pop 1968 (Solomakha, 2008), a phytocoenosis known from other parts of the Svydovets Massif, like Mt. Drahobrat (Malinovskiy, Krichfalusy, 2000; Didukh et al., 2016; Solomakha, 2008; Kobiv et al., 2009).

The botanical importance of calcicole to intermediate subalpine-alpine habitats at the Komyn Cirque is expressed by the number and abundance of threatened species occurring there (Bedei, 2006; Kyyak et al., 2016). According to the Red List for the Ukrainian Carpathians by Kricsfalusy and Budnikov (2007), two taxa (*Cerastium eriophorum*, *Festuca amethystina* subsp. *orientalis*) are vulnerable (VU), six (*Achillea oxyloba* subsp. *schurii*, *Doronicum columnae* subsp. *carpaticum*, *Galium anisophyllon*, *Rhodiola rosea*, *Sabulina verna*, *Saussurea alpina*) are endangered (EN), and one (*Selaginella selaginoides*) is critically endangered (CR). According to the *Red Data Book of Ukraine* (Chervona knyha..., 2009), *Achillea oxyloba* subsp. *schurii*, *Campanula kladniana*, *Sabulina verna* (listed as *Minuartia pauciflora*) and *Saussurea alpina* are rare and *Rhodolia rosea* and *Selaginella selaginoides* are vulnerable. It is worth mentioning, that Komyn harbours the only known population of *Saussurea alpina* in the Svydovets Massif, which was originally (although erroneously) published as *Saussurea discolor* (Willd.) DC. (Kardash, Kyyak, 1991). In the Ukrainian Carpathians, *Saussurea alpina* is a rare arctic-alpine species otherwise known only from the Chornohora (Kyyak, 2009; Cherepanyn, 2017). Another noteworthy species not mentioned in any Red List is the Pan-Carpathian endemic *Thymus pulcherrimus* (Novikoff, Hurdu, 2015; Kliment et al., 2016). In Ukraine it is only known from a dozen populations, from Mt. Blyznytsia and Mt. Drahobrat in the Svydovets Massif as well as from the Chornohora and Chyvchyny (Chopyk, Fedoronchuk, 2015; Nachychko, Honcharenko, 2017).

Due to several factors, micropopulations of *Arabidsopis neglecta* (Fig. 3) in steep slopes of glacial cirques are highly endangered. Very likely, there is no gene flow between them as they are separated geographically in an "island-like" fashion. During a ten-year period of monitoring, *Alnus alnobetula* (*A. viridis*) has overtaken next to *Saussurea alpina* at Komyn, decreasing in suitable microhabitats for pioneer and early-successional cold-dwelling species such as the newly discovered *A. neglecta* (Kyyak et al., 2016). Less snow cover, less erosion due to snowpack shift, less humidity and prolonged vegetation periods are responsible for the trend demonstrating that low-competitive glareophytes such as *A. neglecta* are threatened by overgrowth of subalpine scrubs and dwarf shrubs (Didukh et al., 2016; Kobiv, 2017). Due to climate change, this narrow-range taxon is in general decline in other monitored populations of the Ukrainian Carpathians (Kobiv, 2017). In the Chornohora, one monitored population of *A. neglecta* at Mt. Brebeneskul has been gradually shrinking during a 15-year period (Kobiv, 2018), rendering the discovery of a new population valuable. The unprotected populations from Mt. Gereshaska [Heryshas'ka] (Margittai, 1935) and Mt. Trojaska/polonyna Apshynets (Kobiv et al., 2009) are probably the most endangered ones. They are located c. 0.5 and 1 km aside, respectively, the projected roads and hotels of the planned gigantomaniac ski and spa resort "Svydovets" (Bedernichek, 2017; https://freesvydovets.org) which might cause urbanization, pollution and even destruction of the high mountain habitats in the north-central part of the Svydovets

Massif (Kagalo et al., 2018). All these facts support the categorization "endangered" (EN) for *A. neglecta* in the Ukrainian Carpathians, as used by Kricsfalusy and Budnikov (2007).

Arabidopsis neglecta in the Carpathians – recent publications and outlook

The biological knowledge on *A. neglecta* in the Ukrainian Carpathians is scarce and its detailed distribution is still not well known. In the Western and Southern Carpathians (Slovakia and Romania), two cytotypes of *A. neglecta* do exist (Schmickl et al., 2012; Hohmann et al., 2014; Kolář et al., 2016b), *A. neglecta* subsp. *neglecta* ($2n = 16$) and the taxon informally (provisionally) named "subsp. *robusta*" ($2n = 32$). For the Ukrainian Carpathians, no cytological or genetic data is available so far (Schmickl et al., 2012; Hohmann et al., 2014; Rice et al., 2014; Kolář et al., 2016a, b). More detailed floristic investigations in suitable habitats of the Ukrainian Carpathians could lead to discoveries of further populations, as it has been done in the Southeastern Carpathians by Bartók et al. (2016). Due to the fact that *A. neglecta* is sometimes confused with more common species *Arabidopsis arenosa* (L.) Lawalrée and *A. halleri* (L.) O'Kane & Al-Shehbaz, a critical revision of so far unconfirmed records like that from the Gorgany (Ziman, Tyukh, 2008) – which is not accepted by Chopyk and Fedoronchuk (2015), Novikoff and Hurdu (2015), and Bartók et al. (2016) – should be undertaken. Recent genomic studies showed that the alpine eco- and morphotype of *A. neglecta* evolved repeatedly from lowland *A. arenosa* in the Carpathians (Kolář et al., 2017, Monnahan et al., 2019), rendering a future reclassification necessary. Regardless of any future classification change, either as an infraspecific entity or just a synonym of *A. arenosa*, – a taxon more widespread in the Ukrainian Carpathians (Kotov, 1953; Sychowa, 1985; Chopyk, Fedoronchuk, 2015) and well known from the Svydovets Massif (Klášterský, 1929), – the numerous rare alpine plant species mentioned for Komyn justify this report which should stimulate future research on the genus *Arabidopsis* in the Ukrainian Carpathians.

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