

***Dactylorhiza traunsteineri* (Saut. ex Rchb.) Soó: an unexpected record in the Romanian flora, with a discussion on other critical records of dactylorchids from Romania**

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***Dactylorhiza traunsteineri* (Saut. ex Reichenb.) Soó Románia flórájában**

Összefoglalás – A *Dactylorhiza* Necker ex Nevski bonyolult taxonómiájú génusz, fajaik formagazdagsága, a különböző alakok közötti átmenetek sokasága, valamint a fajok között fellépő gyakori hibridizáció miatt rendszerezésük problematikus. A Valea Morii (Malom-völgy) Természetvédelmi Terület (Kolozs megye, ÉNy Románia) florisztikai kutatása során, 2017 júniusában a Románia flórájára tekintve eddig bizonytalan előfordulású ujjaskosbor, a *Dactylorhiza traunsteineri* (Saut. ex. Rchb.) Soó populációja került elő. A vizsgált helyen a *D. traunsteineri* üde láprétfoltokban, az Orchido-Schoenetum nigricantis Oberd. 1957 társulásban fordul elő. A terület igen hűvös és nedves mikroklímájának köszönhetően jégkori reliktumfajok és egyéb növényritkaságok (például: *Tofieldia calyculata* (L.) Wahlenb., *Swertia perennis* L., *Liparis loeselii* (L.) Rich., *Ophioglossum vulgatum* L., *Schoenus nigricans* L.) voltak képesek fennmaradni a láprétfoltok gyengén bázikus kémhatású, tápanyagban és mészből gazdag talajain. A dolgozat bizonyítja a Traunsteiner ujjaskosbor jelenlétét Románia flórájában, ami a korábbi, ehhez a témához kötődő tudományos viták sorozatát zárja le, továbbá bemutatja a faj morfológiai jellemzőit, határozóbélyegeit, élőhelyét és veszélyeztetettségi státuszát.

Kulcsszavak: elterjedés, Orchidaceae, természetvédelem, ujjaskosbor, veszélyeztetett növényfaj

Abstract – *Dactylorhiza* Necker ex Nevski is a complex genus. The taxonomy of these dactylorchids is widely considered to be complicated due to relatively high morphological variability within species and high frequency of hybridization between species. During a floristic survey of the Valea Morii (Morii Valley, Malomvölgy) Nature Reserve in June 2017, a population of *Dactylorhiza traunsteineri* (Saut. ex. Rchb.) Soó, a species with uncertain presence in the Romanian flora was found. In the Morii Valley, this narrow-leaved marsh-orchid was encountered in fen-patches, in phytocoenoses of the plant association Orchido-Schoenetum nigricantis Oberd. 1957. Due to the cool and wet microclimate of the Morii Valley, many glacial relicts and other plant rarities (e.g. *Tofieldia calyculata* (L.) Wahlenb., *Swertia perennis* (L.), *Liparis loeselii* (L.) Rich., *Ophioglossum vulgatum* L. *Schoenus nigricans* L.) had been able to survive on strongly humid places on calcareous soils. This study reports the first occurrence of *D. traunsteineri* in Romania confirming the presence of a highly debated taxon. We also discuss the morphological features, habitat preference and conservation status of this new species in the Romanian Flora.

Keywords: conservation, distribution, endangered species, marsh orchid, Orchidaceae

Introduction

Dactylorhiza Necker ex Nevski is a difficult monophyletic genus distributed from subtropical to arctic Eurasia and North Africa (DELFORGE 2006). The taxonomy of these dactylorchids is widely considered to be complicated due to the relatively high morphological variability within species and the frequent hybridization between them. At the same time, this genus represents one of the most threatened genera in Orchidaceae in Europe, due to habitat destruction (PILLON *et al.* 2006). *Dactylorhiza* belongs to the subtribe Orchidinae, which has the highest diversification in Eurasia encompassing the majority of European orchids. Different authors distinguished 12–75 species of *Dactylorhiza* in Europe (PEDERSEN 1998, PILLON *et al.* 2006).

According to SÂRBU *et al.* (2013), the genus is represented in the Romanian flora by 7 species namely *Dactylorhiza sambucina* (L.) Soó, *D. maculata* (L.) Soó, *D. fuchsii* (Dreuce) Soó, *D. saccifera* (Brongn.) Soó, *D. incarnata* (L.) Soó, *D. majalis* (Rchb.) P. F. Hunt & Summerh. and *D. cordigera* (Fries) Soó and 5 subspecies: *D. maculata* (L.) Soó subsp. *transsilvanica* (Schur) Soó, *D. maculata* (L.) Soó subsp. *schurii* (Klinge) Soó, *D. fuchsii* (Dreuce) Soó subsp. *sooana* (Borsos) Borsos, *D. incarnata* (L.) Soó subsp. *ochroleuca* (Boll) P. F. Hunt & Summerh. and *D. cordigera* (Fries) Soó subsp. *siculorum* (Soó) Soó.

DELFORGE (2016) recognises 8 species and 3 subspecies from Romania namely *D. incarnata*, *D. sambucina*, *D. majalis*, *D. cordigera*, *D. carpatica* (Batoušek & Kreutz) P. Delforge, *D. schurii* (Klinge) Averyanov, *D. pindica* B. Willing & E. Willing, *D. macedonica* J. Hölzinger & Künkele, *D. fuchsii*, *D. saccifera*, *D. maculata*, *D. incarnata* f. *ochrantha*, *D. cordigera* subsp. *siculorum* and *D. maculata* var. *transsilvanica* (Schur) P. Delforge.

OPREA (2005), CIOCÂRLAN (2009) or SÂRBU *et al.* (2013) accepted the occurrence of *D. incarnata* subsp. *ochroleuca* from Romania. The distribution of this subspecies in the countries surrounding Romania is confirmed only in Hungary where it is currently certified only in 2 locations (MOLNÁR 2011). The presence of this species was never confirmed through herbarium material in Romania (we could not trace any herbarium specimen in all the herbaria investigated). Moreover, we could not find Fen Early Marsh-orchid during the field surveys in the regions of Romania where the taxon was reported from (Cluj, Braşov, Sibiu and Neamţ counties). Thus, we assume that *D. incarnata* subsp. *ochroleuca* was erroneously reported from Romania without any strong support from existing data. It was most likely confused with yellow flowered specimens of *D. incarnata* f. *ochrantha*.

The taxa recently mentioned from Romania by KREUTZ (2014): *Dactylorhiza fuchsii* (Dreuce) Soó subsp. *psychrophila* (Schlechter) J. Holub, *Dactylorhiza fuchsii* (Dreuce) Soó subsp. *sudetica* (Pösch ex Reichenb. fil.) Vermeulen, *D. incarnata* (L.) Soó subsp. *cruenta* (O. F. Mueller) P. D. Sell, *Dactylorhiza kalopissii* E. Nelson subsp. *macedonica* (J. Hölzinger & Künkele) Kreutz and *Dactylorhiza pindica* B. Willing & E. Willing require advanced taxonomical and chorological studies and therefore, will not be included in the present study as part of the Romanian orchid flora.

Very recently, *Dactylorhiza lapponica* (Laest. ex Hartm.) Soó was published as a new species in the Romanian flora in NOBIS *et al.* (2018).

In present study we recognize 10 species, namely *Dactylorhiza viridis* (L.) R. M. Bateman, Pridgeon & M. W. Chase, *D. sambucina* (L.) Soó, *D. maculata* (L.) Soó, *D. fuchsii* (Dreuce) Soó, *D. saccifera* (Brongn.) Soó, *D. incarnata* (L.) Soó, *D. cordigera* (Fries) Soó, *D. majalis* (Rchb.) P. F. Hunt & Summerh., *D. lapponica* (Laest. ex Hartm.) Soó, *D. traunsteineri* (Saut. ex Reichenb.) Soó and 3 subspecies (*D. maculata* subsp. *transsilvanica*, *D. maculata* subsp. *schurii*, *D. cordigera* subsp. *siculorum*) of dactylorchids from Romania.

During the botanical survey of Valea Morii Nature Reserve in northwestern Romania (Cluj county) *Dactylorhiza traunsteineri*, a species with unclear distribution in the Romanian flora was found among other threatened plants in fen-patches in June 2017 (BARTÓK & BRĂDEANU 2018).

The aims of our study were to (1) analyze morphometric traits of the species found in Romania, (2) describe the habitat characteristics of the population found in Valea Morii Nature Reserve, (3) evaluate the conservation status of *D. traunsteineri* in Romania.

Material and methods

Our investigations build upon extensive field studies, inspection of herbarium collections in CL, BP, BUC, BUCA, BVS, SIB, I, IAGB, IASI, CRAI (abbreviations following THIERS 2018), as well as literature surveys. All existing herbarium material was revised and all available information from the botanical literature was critically compiled in order to clarify the distribution of certain *Dactylorhiza* taxa (e.g. *D. incarnata* subsp. *ochroleuca*) in Romania. Several field surveys were carried out between 2003 and 2018 in the Romanian Carpathians, covering the areas where *D. incarnata* subsp. *ochroleuca* was previously reported (Cluj, Braşov, Sibiu and Neamţ counties).

For the identification of specimens floristic monographs (PAUCĂ & BELDIE 1972, SOÓ 1980, REINHARD *et al.* 1991, LAUBER & WAGNER 2000) were consulted. The nomenclature follows the Euro+Med Plantbase (<http://www.emplantbase.org>).

Voucher specimen of collected *D. traunsteineri* is deposited in the private herbarium of A. Bartók (Bucharest).

Former erroneous mentions of *Dactylorhiza traunsteineri* in Romania

SCHUR (1866) in his floristic monograph was the first to report this taxon from Transylvania, more precisely from the vicinity of Borsec and Tuşnad localities. In his floristic synthesis, FUSS (1866) cited this taxon after SCHUR (1866), but he questioned its presence in Transylvania. Moreover, in his monograph on the Transylvanian vascular flora, Simonkai eliminated *D. traunsteineri* from the list of plants to be found near Borsec or Tuşnad (SIMONKAI 1887) assuming that it was the more commonly encountered taxon „*Orchis incarnata* L.”.

In addition, SOÓ (1940, 1943) and PAUCĂ & BELDIE (1972) questioned the presence of this species in Transylvania and they believed that it was confused, probably with „*Orchis maculata* L. subsp. *elodes* (Gris.) Camus var. *schurii* (Klinge)”.

Uechtritz and Sintenis (KANITZ 1879–1881) mentioned the Narrow-leaved Marsh-orchid (under “*Orchis angustifolia*”) from Dobrudja, in the Danube Delta for the first time, but without exact locality. PANȚU (1915) cited *D. traunsteineri* in the monograph of Romanian orchids, but he only referred to Kanitz’s data and questioned its presence from Dobrudja. We could not find any herbarium voucher of this species from Dobrudja or any proof of its occurrence in the field in this region. We strongly believe that it was confused, probably with *Anacamptis laxiflora* (Lam.) R. M. Bateman, Pridgeon & M. W. Chase, since this species is frequently encountered in this region.

However, we have found a neglected herbarium sheet (BP 32395), collected 140 years ago by Simonkai (as “*Orchis ambigua* var. *claudiopolitana*”) near Cluj-Napoca, in Valea Morii area (Fig. 1). Our results demonstrate beyond doubt that this taxon, the occurrence of which was highly debated in the scientific community, is present in Romania.



Fig. 1. Original herbarium sheet with the first collection of *Dactylorhiza traunsteineri* (as *Orchis ambigua* var. *claudiopolitana*) from Morii Valley by L. Simonkai (BP 32395), for details, see text
1. ábra. Simonkai Lajos *Dactylorhiza traunsteineri* példánya (*Orchis ambigua* var. *claudiopolitana* néven) (BP 32395)

Distribution, taxonomic notes and morphometric data

Originally, Reichenbach gave what was the first brief description of *D. traunsteineri* from Kitzbühel (Austria) as *Orchis traunsteineri*, quoting Sauter as the authority (REICHENBACH 1830–1832).

D. traunsteineri is a European species distributed in Scandinavia, the Alps, the Baltic countries, northwestern Russia, Central Russia and the Ural Mountains (HULTÉNE & FRIES 1986, REINHARD *et al.* 1991, AVERYANOV 2000, MAMAEV *et al.* 2004, EFIMOV 2011).

To our current knowledge, the distribution of *D. traunsteineri* in Romania is restricted to the Morii Valley area.

Dactylorhiza traunsteineri sensu lato is a highly variable, tetraploid aggregate of narrow-leaved marsh orchids with a poorly known distribution. *D. traunsteineri* together with *D. lapponica* are taxa with rather cryptic characters whose distinguishing characteristics (and therefore taxonomical status and distributions) remain controversial. However, extensive field work with subsequent statistical analyses in order to discriminate the two species has proved that many characteristics are intermediate not only between them, but in the whole complex of *D. majalis*–*lapponica*–*traunsteineri* (REINHARD 1985). Therefore it is not surprising that a large number of species and infraspecific taxa belonging to the *D. traunsteineri* group has been described throughout the years.

Nevertheless, both taxa (*D. traunsteineri* and *D. lapponica*) are accepted in most of the recent European floras (KROK & ALMQUIST 2001, MOSSBERG & STENBERG 2003, AESCHIMANN *et al.* 2004, LID & LID 2005, BAUMANN *et al.* 2006, DELFORGE 2016).

The main diagnostic characters of *D. traunsteineri* are: long narrow leaves, a lax, few-flowered inflorescence with relatively large flowers, each having a relatively broad trilobed labellum and spotted or unspotted leaves, which are well-spaced along the stem (REINHARD 1985). Morphological differences between the three species (*D. majalis*, *D. lapponica*, *D. traunsteineri*) are summarized in Table 1.

Table 1. Morphological difference between *Dactylorhiza majalis*, *D. traunsteineri* and *D. lapponica* after REINHARD *et al.* (1991)

1. táblázat. Morfológiai különbségek a *Dactylorhiza majalis*, *D. traunsteineri* és *D. lapponica* között, REINHARD *et al.* (1991) alapján

Characters	<i>D. majalis</i>	<i>D. traunsteineri</i>	<i>D. lapponica</i>
Height of stem (cm)	20–90	20–40	10–30
Number of leaves	4–10	3–5	2–5
Length of leaves (cm)	5–16	3–16	2,5–7(–9)
Width of leaves (cm)	2–3(–5)	0,5–1,5	0,6–2,5
Number of flowers	10–60	12(–20)	3–20
Length of inflorescence (cm)	2–16	3–10	2–7
Length of labellum (mm)	5–10	7–9	5,5–7
Length of spur (mm)	8,5–10	8–14	6,5–9

The morphometric data of the *D. traunsteineri* population found in Morii Valley are presented in Table 2.

Table 2. Morphological comparison of *Dactylorhiza traunsteineri* from Romania (Morii Valley) (ined) with populations from the European Alps (Switzerland) (after REINHARD *et al.* 1991)**2. táblázat.** A *Dactylorhiza traunsteineri* romániai (Malomvölgy) és svájci (Alpok) populációinak morfológiai összehasonlítása

Characters	Romania (Valea Morii) [n=20]	European Alps
Height of stem (cm)	40–46	10–40
Number of leaves	3–5	(2–)3–4(–5)
Length of leaves (cm)	13–15	4–15
Width of leaves (cm)	0,5–1	0,5–1,5
Number of flowers	10–15	5–15(–20)
Length of inflorescence (cm)	5–7	3–8
Width of labellum (mm)	7–9	6,5–10
Length of spur (mm)	10–13	8–14
Spur max. width flattened (mm)	2–3	2–3,5

Habitat characteristics of *Dactylorhiza traunsteineri* from Morii Valley

The Valea Morii Nature Reserve is situated ca. 8 km south of Cluj-Napoca (Cluj county), southwestward to Feleacu at 650 m above sea level. The vegetation in the valley is comprised by oak, oak-hornbeam, beech and hornbeam-beech forests. On the slopes of the valley there are mesophilous and poor meso-xerophilous hayfields. Rich clayey fens which are fed by calcareous ground water are patchily inserted into the hayfields (RUPRECHT & BOTTA-DUKÁT 2000).

The phytocoenoses where *D. traunsteineri* was recorded belong to Orchido-Schoenetum nigricantis Oberd. 1957 (Table 3). The dominant species is *Schoenus nigricans* L., seconded by *Eriophorum latifolium* Hoppe and *Carex cespitosa* L. Of the diagnostic calciphilous species of the alliance Caricion davallianae Klika 1934 and higher syntaxa, several species are well represented: *Dactylorhiza traunsteineri*, *Tofieldia calyculata* (L.) Wahlenb., *Carex echinata* Murray, *Dactylorhiza majalis* (Rchb.) P.F.Hunt & Summerh., *Crepis paludosa* (L.) Moench (Table 3.).

The Orchido-Schoenetum nigricantis association could be found on strongly humid places on calcareous soils. This association is considered to be successional stable, which is maintained by adequate moisture conditions and regular mowing and grazing.

Due to the cool and wet microclimate of the Morii Valley, many glacial relicts and other plant rarities (e.g. *Tofieldia calyculata* (L.) Wahlenb., *Swertia perennis* L., *Liparis loeselii* (L.) Rich., *Ophioglossum vulgatum* L., *Schoenus nigricans* L., *Ligularia sibirica* (L.) Cass. and *Phyteuma orbiculare* L.) (Fig. 2.) had been able to survive on strongly humid places on calcareous soils.

European populations of *D. traunsteineri* occur in calcium-rich habitats (REINHARD *et al.* 1991, AESCHIMANN *et al.* 2004, HANHELA 2008, NORDSTRÖM & HEDRÉN 2008, BATEMAN 2011), however, other authors (VAKHRAMEEVA & TATARENKO 2001, VAKHRAMEEVA *et al.* 2008) report that the species grows on acidic soils.

In Morii Valley the species grows on calcareous soils, in a habitat with relatively neutral substrate (pH = 7.3–7.8) (RUPRECHT 1999).

A comprehensive vascular plant inventory of this nature reserve consists of 509 species (CSÜRÖS & CSÜRÖS 1996). This place preserves many valuable plant species like *Tofieldia calyculata* (the only certain population on the Romanian territory) or *Liparis loeselii* (very rare and Critically Endangered species in South-Eastern Carpathians). Unfortunately, some rare species (*Achillea impatiens* L., *Herminium monorchis* (L.) R.Br., *Carex sibirica* L. and *Menyanthes trifoliata* L.) are probably extinct in Morii Valley because repeated endeavors to find these species in the nature reserve area failed.

Table 3. Floristic composition of *Orchido-Schoenetum nigricantis* Oberd. 1957 association in Morii Valley
3. táblázat. *Orchido-Schoenetum nigricantis* Oberd. 1957 asszociáció a Malom-völgyben

Relevé no.	1	2
Date of relevé	16.VI.2017.	
Slope (°)	10	15
Elevation (m, a.s.l.)	650	650
Aspect	NE	N
Sample plot size (m ²)	25	25
Grass cover (%)	80	85
<i>Orchido-Schoenetum nigricantis</i> Oberd. 1957		
<i>Antennaria dioica</i>	+	+
<i>Briza media</i>	+	.
<i>Carex caespitosa</i>	+	+
<i>Carex echinata</i>	+	+
<i>Cirsium erisithales</i>	+	.
<i>Cirsium palustre</i>	+	.
<i>Cladium mariscus</i>	.	+
<i>Crepis paludosa</i>	.	+
<i>Dactylorhiza majalis</i>	+	.
<i>Dactylorhiza traunsteineri</i>	+	+
<i>Epipactis palustris</i>	+	.
<i>Equisteum palustre</i>	+	+
<i>Eriophorum latifolium</i>	+	+
<i>Festuca rubra</i>	+	.
<i>Tofieldia calyculata</i>	+	+
<i>Juncus articulatus</i>	+	.
<i>Molinia caerulea</i>	.	+
<i>Phragmites australis</i>	1	1
<i>Phyteuma orbiculare</i>	+	.
<i>Polygala vulgaris</i>	+	+
<i>Schoenus nigricans</i>	3–4	2–3
<i>Scirpus sylvaticus</i>	.	+

Conservation status of *Dactylorhiza traunsteineri* in the South-Eastern Carpathians

Only one population of *D. traunsteineri* is known with certainty in Romania, specifically in the Morii Valley Nature Reserve.

The population of Valea Morii Nature Reserve consists of ca. 150–200 specimens within an area of 16,7 km² (area of occurrence) out of which ca. 100 individuals are estimated to be mature. Furthermore, its area of occupancy (AOO) is estimated to be less than 8 km².

Unfortunately, the protected territories mentioned above are exposed to intense grazing. Other threats in Valea Morii Nature Reserve are related to, land use violation by illegal construction, the succession of natural vegetation (due to *Phragmites australis* (Cav.) Steud. extension) and the drainage of fen-patches.

D. traunsteineri is protected by the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) (HAGSATER & DUMONT 1996).

Although the species is not listed in the The IUCN Red List of Threatened Species, based on this study, applying the IUCN Red List Categories and Criteria (IUCN 2012), we estimate the current threatened status of *D. traunsteineri* to be Critically Endangered [criteria B1ac(i, ii, iii)+ B2ac(i, ii, iii); C2a(ii)] in Romania.

We therefore recommend the inclusion of *D. traunsteineri* in the next edition of the Romanian Red Book of Vascular Plants.

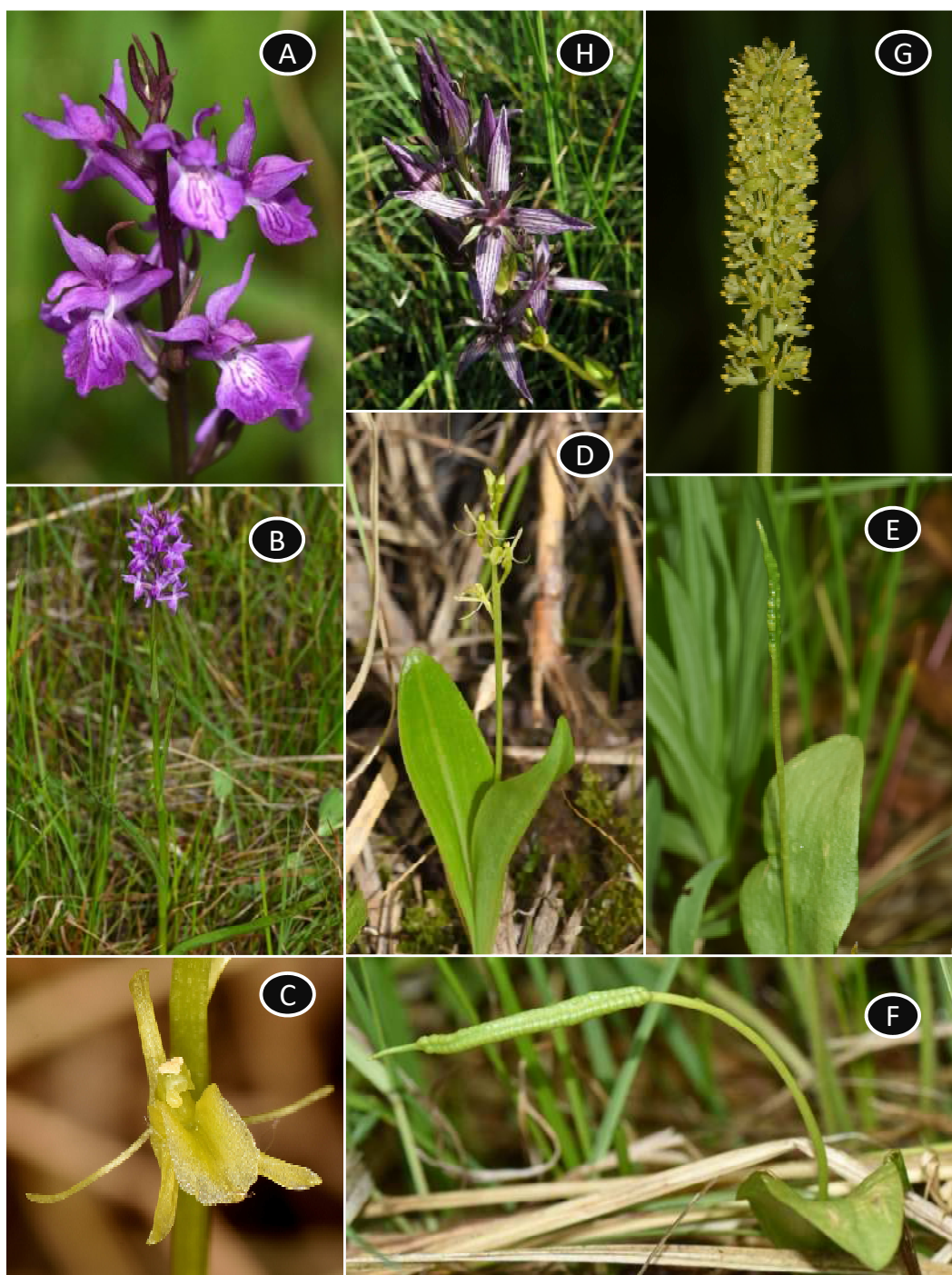


Fig. 2. Rare and endangered species from Valea Morii Nature Reserve
(photographs by A. Brădeanu & A. Bartók)

2. ábra. Ritka és veszélyeztetett fajok a Malom-völgy Természetvédelmi Területen
(Brădeanu A. és Bartók A. felvételei)

A, B - *Dactylorhiza traunsteineri* (Saut. ex. Rchb.) Soó; C, D - *Liparis loeselii* (L.) Rich.;
E, F - *Ophioglossum vulgatum* L.; G - *Tofieldia calyculata* (L.) Wahlenb.; H - *Swertia perennis* L.

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