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Chamorchis alpina and *Epipactis helleborine* in the Murmansk Region, Russia, and assessments of the orchids in the Region using the IUCN Red List Categories

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The old record of *Chamorchis alpina* from Rybachiy Peninsula, Murmansk Region has been confirmed and another old locality reported from Pechenga on the basis of two herbarium specimens collected by Jacob Fellman (H). The specimen from Pechenga was wrongly published as *Herminium monorchis* in Fellman's Index plantarum 1831. *Chamorchis alpina* has not been found in the Murmansk Region since more than 180 years, and it is proposed to be treated as regionally extinct (RE) in the Red Data Books dealing with the Region.

Epipactis helleborine, recently reported from the District of Kandalaksha, should be added to the regional Red Data Book as a critically endangered (CR) species. Five species relic for polar latitudes – *Calypso bulbosa, Cypripedium calceolus, Epipogium aphyllum, Hammarbya paludosa* and *Malaxis monophyllos* – better belong to critically endangered (CR) than endangered (EN) species. *Dactylorhiza traunsteineri*, known only from two localities, should be moved from vulnerable (VU) to critically endangered (CR). *Dactylorhiza incarnata*, small populations of which show drastic fluctuations, should be treated as endangered (EN) instead of vulnerable (VU). *Coeloglossum viride, Corallorhiza trifida, Gymnadenia conopsea* and *Listera cordata* should be transferred from VU to a group of species in need of monitoring. *Leucorchis albida* should be included as Vulnerable in the National Red Data Book of Russia. *Dactylorhiza fuchsii* should belong to the category of Data Deficient (DD).

The Murmansk Region, located in the north-eastern corner of Russian Fennoscandia, is a part of the Atlantic-Arctic zone of temperate belt with a rather mild climate. This kind of climate allowed a representative European orchid flora to develop: 20 species of 15 genera are known from the Region (Table 1). All orchid species which occur in the Region are included in various Red List categories of the most recent regional Red Data Book (Blinova 2003), except for *Epipactis helleborine* found recently. However, a re-evaluation is needed for the category of more than half of the species.

Chamorchis alpina

Jacob Fellman (1795–1875) was one of the first Finnish botanists who travelled to the Kola Peninsula already in the early 1800's. On the basis

Table 1. A list of orchid species which occur in the Murmansk Region, with their current status in the regional Red Data Book and the proposed new status.

Species	Category in the Red Data Book of the Murmansk Region (Konstantinova & al. 2003)	Proposed category to the New Edition of the Red Data Book of the Murmansk Region
Calypso bulbosa (L.) Oakes	EN	CR
Chamorchis alpina (L.) Rich.	EN	RE
Coeloglossum viride (L.) Hartm.	VU	Need of monitoring
Corallorhiza trifida Châtel.	VU	Need of monitoring
Cypripedium calceolus L.	EN	CR
Dactylorhiza fuchsii (Druce) Soó	– **	DD
Dactylorhiza incarnata (L.) Soó	VU	EN
Dactylorhiza maculata (L.) Soó	Need of monitoring	Need of monitoring
Dactylorhiza traunsteineri (Rchb.) Soó *	VU	CR
Epipactis atrorubens (Hoffm.) Besser	EN	EN
Epipactis helleborine (L.) Crantz	– ***	CR
Epipogium aphyllum Sw.	EN	CR
Goodyera repens (L.) R. Br.	VU	VU
Gymnadenia conopsea (L.) R. Br.	VU	Need of monitoring
Hammarbya paludosa (L.) Kuntze	EN	CR
Leucorchis albida (L.) E. Mey.	VU	VU
Listera cordata (L.) R. Br.	VU	Need of monitoring
Listera ovata (L.) R. Br.	EN	EN
Malaxis monophyllos (L.) Sw.	EN	CR
Platanthera bifolia (L.) Rich.	EN	EN

*) Treated in wide sense, incl. *D. lapponica* (Hartm.) Soó (= *D. majalis* (Rchb.) P. F. Hunt & Summerh. subsp. *lapponica* (Hartm.) H. Sundermann) and *D. curvifolia* (F. Nyl.) Czerep.

**) Not recognized, included in *D. maculata.*

***) Not recorded, the specimen misidentified as *E. atrorubens.*

of his excursions, mainly in 1829, he wrote the first catalogue of the flora of the Kola Peninsula (J. Fellman 1831; reprinted, with slight corrections, in J. Fellman 1906b). *Chamorchis alpina* was listed in the catalogue as *Chamaerepes alpina* from Karelsgammen (J. Fellman 1831). Karelsgammen is an old name for Vayda-Guba [Vaitolahti], the northernmost village of the Rybachiy Peninsula [Kalastajasaarento] close to the border of *Lapponia petsamoensis*. Starting from the oldest national Floras (Ledebour 1853) to relatively recent ones (Smoljianinova 1986) this has been the only locality known for this species in Russia. Jacob Fellman's son Nils Isak Fellman (1841–1919) amended and expanded the catalogue, and changed the name *Chamaerepes* to *Chamorchis* (N. I. Fellman 1869). He also added "*pl. exs.*", which may indicate that he had seen specimen(s). The main area of *Chamorchis alpina* is in Scandinavian high mountain area in Norway, Sweden and Finland (*Le*), and isolated localities exist in the Alps and the Carpathians (Hultén & Fries 1986).

Immediately after the Great Fire of Turku in September 1827 Johan Magnus af Tengström (1793–1856), at that time curator of the zoological and botanical collections of the Royal Academy of Turku and after the fire the Imperial Alexander University of Finland, corresponded with Jacob Fellman of the duplicate set of his herbarium, which Fellman had decided to donate to the re-established university herbarium in Helsinki (Fellman 1906b). Probably this material was received to Helsinki already in the early 1830s,

and it is incorporated into the arranged systematic collection of H. No *Chamorchis* from the Kola Peninsula is included in this set.

However, Fellman's main collection was received later, and it remained separate and untreated; there were difficulties to provide labels for the material on the basis of Fellman's incomplete notes on the specimens. Only recently the notes on herbarium sheets and information from N. I. Fellman (1869) were combined and proper labels were provided for the specimens (Väre 2011). Checking of the specimens in this collection revealed that Jacob Fellman collected two specimens of *Chamorchis alpina* from the Kola Peninsula (fig. 1), both named by himself as *Ophrys alpina*. One is from *Lapponia petsamoensis* (*Lps*), Rybachiy Peninsula ("*Ad peninsulam Karelsgammen districtu Kolaensi*"; H 1746362), and it confirms the information published by him. The other specimen is also from *Lapponia petsamoensis*, from the mountains near village Pechenga [Petsamo] ("*Ad alpes Peisen*"; H 1746361; fig. 2).

Two interesting sheets of *Chamorchis alpina* were located at the Herbarium of Komarov Botanical Institute (LE) in Russia. The label with "*Ophrys alpina, lect. in Lapponia, m[isit] rever[endus] Fellmann Utsjoki 1825*" [manu C. A. Meyer] on one of them indicates that Fellman sent the specimen in 1825 to Dorpat (Tartu, Estonia), possibly to C. F. Ledebour, with whom he was in correspondence. The specimen found its way to C. A. Meyer, who was at that time an apothecary at Dorpat and at the same time assistant to Ledebour in Dorpat Botanical Garden (Ruprecht 1855). Meyer's herbarium was acquired to the Museum of St. Petersburg Botanic Garden (part of LE) after his death (Lipschitz & Vasilczenko 1968). The specimen cannot be from

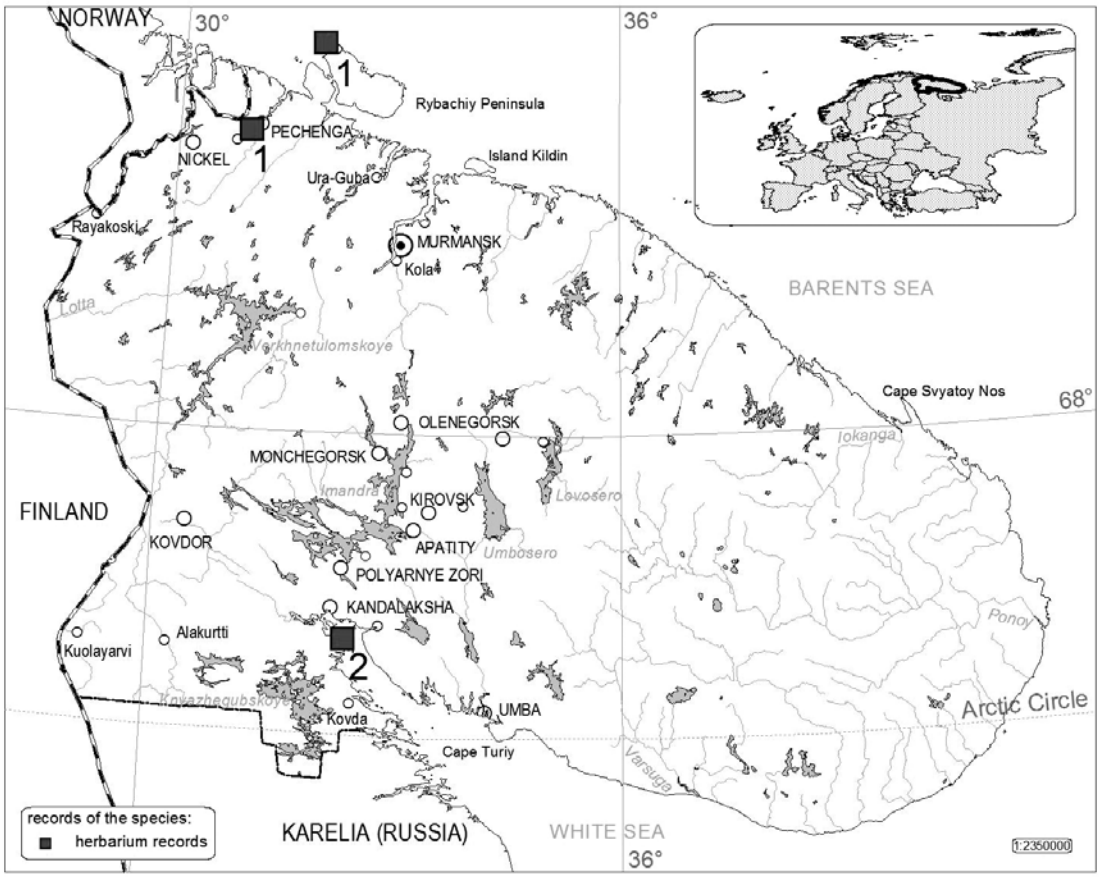

Fig. 1. Sites with *Chamorchis alpina* (1*) and Epipactis helleborine* (2) in the Murmansk Region (Russia).

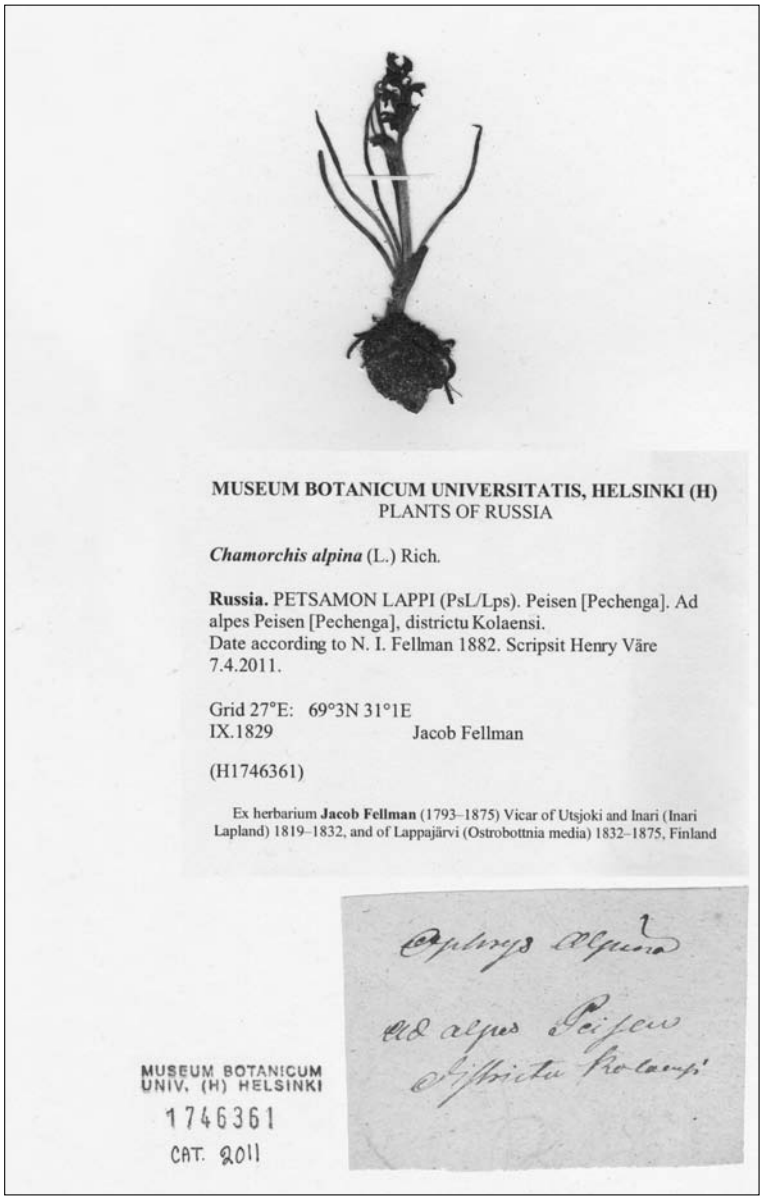

Fig. 2. A specimen of *Chamorchis alpina*, collected by Jacob Fellman from *Lps* Pechenga (H 1746361).

the Kola Peninsula, because Fellman's first journey to the Kola Peninsula was only in 1826, except for a brief visit near the coast in 1820 (for details, see Väre 2011). However, in 1822 Fellman visited Norway, Øst-Finnmark, Berlevåg, and evidently collected *Chamorchis alpina* (as *Ophrys alpina*) there (Fellman 1906a: 114). Under *Chamaerepes alpina* Ledebour (1853) gives Hab. in Rossia arctica, "territor. Kola (Fellm.)", and "Lapponia ! Tangström [J. M. af Tengström] *pl. exs*.". The first locality is borrowed from J. Fellman (1831), and the exclamation mark in the second one indicates that he had seen a specimen. Tengström did not visit Lapland at all, but he exchanged specimens with Fellman and, on the other hand, corresponded with Ledebour. So, it is probable that the specimen was collected by Fellman from Norway in 1822 and sent to Tengström, who re-sent it to Ledebour. This explains "Tangström pl. exs." and an exclamation mark in Ledebour (1853). If Fellman sent more material to Tengström, it burnt in the Great Fire of Turku.

However, in H there is a specimen of *Ophrys alpina* [manu Fellman; H 1754472], which was mounted to the same sheet as another Norwegian specimen from the 1800's. The specimen probably belongs to the material sent by Fellman for re-establishment of the new collections.

The other sheet in LE bears the name *Chamaerepes alpina* (as in Ledebour 1853) and has no collecting data, but only references to "Led. IV p. 74 N1", which is the citation of J. Fellman (1831) in Ledebour (1853), and "Fellmann, Index Kola, N 331" (J. Fellman 1831). The information was probably written by a herbarium curator, and possibly the sheet belongs to the same collection as the previous sheet.

The flora of the areas in the Kola Peninsula where *Chamorchis alpina* was found by Fellman has been studied quite much in early 1900s by Finnish botanists and after the Second World War by Russian botanists, but the species has not been re-found. Because the species has not been seen for more than 180 years in the Murmansk Region, we propose that — according to the classification by IUCN (1994, 2003) — it should be included in regionally extinct species (RE) in both National Red Data Book of Russian Federation and Regional Red Data Book of the Murmansk Region.

Herminium monorchis / *Platanthera oligantha*

In his catalogue J. Fellman (1831) lists *Herminium monorchis* from Pechenga ("*ad Peisen rarissime*"). Referring to that work, Ledebour (1853) mentions *Herminium monorchis* from Kola. N. I. Fellman (1869) regards this orchid as *Platanthera obtusata* ("*Etiam in Porsangria Finmarchiae orientalis: Gunnerus ex Whlnb. Fl. Lapp. P. 217. Cl. Lund et Hartman eam, quoad plantam Finmarchicam, Platantheram obtusatam Lindl. representare opinantur; Hrtm. Skand. Fl. ed. P. 234*"). Klinggräff (1878: 67) lists *P. obtusata* as one of the species which occurs in "russischem Lapland und zum Teil Ostfinnmarken". The source of the information concerning Russian Lapland was unknown to Hjelt (1895), who doubts both the original information and N. I. Fellman's intepretation. However, the information can originate from N. I. Fellman's study, which was published as preprint already in1869, but in the periodical 13 years later, in 1882 (see Dorr & Nicolson 2008). After Hjelt Finnish authors have not accepted the species in the Finnish Floras where the Kola Peninsula was included (Cajander 1906, Hiitonen 1933). Also in Russia the original record by J. Fellman (1831) was considered erroneous.

The finding of Fellman's specimen of *Chamorchis alpina* from Pechenga, and missing of other orchid specimens from that area in his herbarium confirms that there is a mistake in J. Fellman (1831). Probably the publication was written first and the specimens studied later, because also *Chamaerepes alpina* was changed to *Ophrys alpina*. It is also evident that the specimen has not been available to N. I. Fellman, who certainly would have corrected the mistake if seen the specimen when preparing his catalogue (N. I. Fellman 1869).

Consequently, *Platanthera oligantha* Turcz. (*P. obtusata* subsp. *oligantha* (Turcz.) Hultén, *Lysiella oligantha* (Turcz.) Nevski; for taxonomy, see Efimov 2007) has not been found in the Kola Peninsula. The nearest and only European findings of this very rare and threatened orchid are from a small area in Finnmark, Norway (Lid & Lid 2005), Torne Lappmark, Sweden (Aronsson 1995), and Enontekiö Lapland, Finland (Mäkelä 2009).

Epipactis helleborine

The only locality of *Epipactis helleborine* in the Murmansk Region is known from *Karelia keretina* (*Kk*), Ryashkov Island in the northern archipelago of the White Sea (Blinova & Moskvicheva 2010, Blinova 2011a; fig. 1). The locality has been known since 1981, but the plants were at first misidentified as *Epipactis atrorubens*. So, *E. helleborine* is missing from Flora of the Murmansk Region (Orlova 1954) and the actual Red Data Book of the Murmansk Region (Konstantinova & al. 2003). At present the species is under protection because the growing site belongs to the territory of the Kandalaksha Nature Reserve.

We recommend that *Epipactis helleborine* is to be included in the next edition of the Red Data Book of Murmansk Region with the status of critically endangered species (CR) because of sever-

al reasons. Ryashkov Island is an isolated locality, the northernmost one of this species in Russia (ca. 67°N). It is far from the nearest known locations in the southern part of the Republic of Karelia (ca. 63°N), South Finland (ca. 65°N), North Sweden (ca. 63°N) and Northwest Norway (ca. 70°N) (Hultén & Fries 1986; specimens in H, PTZ, TROM). It deviates from the nearest sites because of its coastal situation. Further, the monitoring of this population in 1982–1986 revealed great fluctuations in the total number of individuals, from 4 to 66 (Vorobyeva & Panarin 1994, as *E. atrorubens*). In 1987 no plant was found in the population. Some plants were seen again in 1998 (Moskvicheva, pers. comm.). In 2010 three flowering individuals and vegetative one (all at distance from each other) were found (Blinova 2011a). Climatic effects seem to be crucial factors hampering the distribution of this species in the Murmansk Region. Its flowering period continues to the latter half of August, and there is only little chance for it to get ripe seeds. The emergence of *E. helleborine* individuals took place in a series of years with exceptionally warm temperature.

Revised Red List categories for orchids in the Murmansk Region

Despite the fact that principles confirmed by the IUCN for the Red List categories have been adopted in national and regional Red Data Books in Russia, the categories have not been strictly followed (Table 2). The categories 0–5 are used in all Red Data Books in Russia. Some species which do not fit with the IUCN categories, but which have to be monitored, were traditionally included in the Red Data Books of the Murmansk Region in the group of "In need of monitoring" (Konstantinova & al. 2003).

Of the 514 vascular plants included in the national Red Data Book in Russia, there are 65 orchid species (Bardunov & Novikov 2008). In the national list of endangered orchid species only four species occur in North-East Fennoscandia: *Cypripedium calceolus, Calypso bulbosa, Epipogium aphyllum* and *Dactylorhiza traunsteineri*.

Testing of the IUCN-criteria (IUCN 1994, 2001, 2003) for orchid species in the Murmansk Region showed that the most applicable criteria were Criterion A (reduction of population size), Criterion B (fragmented area, continuous decline or extreme fluctuations) and Criterion D (very small or restricted population). Further studies aimed at the causes of orchid rarity in the North-Eastern Fennoscandia, and characteristics which might be related to the regional abundance of the species were analyzed at the individual, population and species levels (Blinova 2009a). The criteria used were: seed set and reproduction by vegetative means, area of the population, effective size of the population (number of flowering shoots), per cent of the young individuals (seedlings and juvenile), abiotic ecological range (sensitivity to the presence of calcium in soil, water level, etc.), phytocoenotic relationships, and duration of the seasonal development compared to the length of the growing period. Further, fluctuations in population size over the time have been analyzed in long-term studies (Blinova & Chmielewski 2008, Blinova 2009b).

As a result of these investigations seven Critically Endangered orchid species were recognized in the Murmansk Region: *Calypso bulbosa, Cypripedium calceolus, Dactylorhiza traunsteineri, Epipogium aphyllum, Epipactis helleborine, Hammarbya paludosa* and *Malaxis monophyllos*.

Table 2. A comparison of the international Red List categories proposed by IUCN (1994) and those used in the Red Data Book of Murmansk Region (Konstantinova & al. 2003).

IUCN 1994	Red Data Book of Murmansk Region 2003
EX (extinct) *	0
EW (extinct in the wild)	absent
CR (critically endangered)	1a
EN (endangered)	1b
VU (vulnerable)	2, 3
NT (near threatened)	6
CD (conservation dependent)	5
LC (least concern)	6
DD (data deficient)	4
NE (not evaluated)	4
NT, LC, DD, in part	In need of monitoring

*) A new category, Regionally Extinct (RE) added by IUCN (2003) for regional extinction.

Four of them are protected at the national level. Except for two species, *Dactylorhiza traunsteineri* and *Epipactis helleborine*, this group consists of relic orchid species which may have ancient distribution areas at polar latitudes, but at present their biological traits like seasonal development, pollination biology, association with certain syntaxa and temperature requirements conflict with the actual environment (Blinova 2008a,b, 2011b).

Many old records of *Dactylorhiza traunsteineri* are erroneous. This species was excluded from the flora of the Murmansk Region by L. Averyanov in the 1980's when he revised the herbarium specimens of *Dactylorhiza* in KPABG. However, one new population was found in 2011, and another site was revealed from an old herbarium specimen, dated 1934 (KPABG). Both are from *Lapponia Imandrae* (*Lim*). The size of the new population was only 48 individuals, 23 of which were at generative stage. The area of the biotope was ca. 470 m^2, and the population size ca. 100 m^2. Critically Endangered is more appropriate status for this species in the Murmansk Region than Vulnerable.

Dactylorhiza incarnata should be categorized as Endangered instead of Vulnerable because of drastic fluctuations in small-sized populations, rather restricted area mostly in the southern and south-western parts of the Murmansk Region, and a narrow phytocoenotic range — occurrences are in communities of the alliances *Caricion lasiocarpae* van der Berghen in Leburn et al. 1949 and *Caricion davallianae* Klika 1934.

Leucorchis albida, which is Vulnerable in the Regional Red Data Book, should be Vulnerable also in the National Red Data Book. The range of this species is mainly confined to Fennoscandia and European mountains. In the Murmansk Region populations occur in three disjunctive areas in communities of the alliance *Kobresio – Dryadion* Norh. 1936. *L. albida* is rare in northern Russia, which means that the Murmansk Region has responsibility for the protection of this species not only regionally but in the whole Russia, and globally as well.

Four species, *Coeloglossum viride, Corallorhiza trifida, Gymnadenia conopsea* and *Listera cordata*, which are distributed throughout the Region and have relatively wide range of ecological requirements, should be moved from Vulnerable to Need of monitoring. Populations of these species are stable in size and have sufficient reproductive success.

The speciation of *Dactylorhiza maculata* s.l. has taken place relatively recently and rapidly, and evolutionary processes are especially active at the northern peripheries of its range. This has resulted in a number of closely related, poorly defined taxa with unclear borders, and their actual distribution areas are unclear as well. A preliminary study of herbarium material from KPABG along with images of flower lips revealed only a few specimens which could be determined as *D. fuchsii*. Most of them are from the southern — south-western part of the Murmansk Region. Probably this species is rare for the region, but additional field research is required. We propose to recognize *Dactylorhiza fuchsii* (previously included in *Dactylorhiza maculata*) for the Murmansk Region, but to categorize it at present as Data Deficient (DD) in the New Regional Data Book.

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