ORCHID FLORA OF MURMANSK REGION (NORTH-WEST RUSSIA): HISTORY, PHYTOGEOGRAPHY, ECOLOGY AND CONSERVATION

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Abstract

The earliest orchid records from Murmansk Region (north-west Russia) date from the 19th century. The largest orchid herbarium collections from this area are now kept at the Polar-Alpine Botanical Garden-Institute (~500 sheets) and in the University of Helsinki (~300 sheets). Since 1991 local orchid studies have been focussed on morphology, morphogenesis and population biology.

15 genera with 19 species are present here, which may be considered relatively rich for a territory situated almost entirely north of the Arctic Circle. Taxonomic problems exist only with Dactylorhiza spp. Most of the orchids are boreal species with a circumpolar or eurasiatic range. Two species only belong to the arctic-alpine element and are confined to Europe. Root-tuber and rhizome life-forms prevail rather than stem-tuber and coralloid rhizome ones.

All these orchids are at the northernmost limit of their distribution and mainly reach only to the central regions, typically low temperatures are the limiting factor. Most of them grow in north-taiga forest communities: only two orchids can be considered as tundra species. Many of these orchids are classified as Critically Endangered and require a high degree of protection.

INTRODUCTION

The first records of orchids in the territory of Murmansk Region were made as long ago as the 19th century, with the colonization of the region at that time and the first floristic expeditions to different parts of it, mostly to the north-west, west and central areas. No special attention was given to orchids but many orchid species are represented in the herbaria and included in the inventory lists of certain areas. Because Finland was a part of Russia during 1809-1917, but then became an independent state, herbarium collections of the region have been
dispersed between different countries and, for a long time – almost until the 1990s - any collaboration was very limited. At present the collections made by Brotherus V.F., Kihlman A.O., Nylander Fr. & Cajander A. are kept in the Finnish Herbarium of Natural History (H). In 1931 the first academic and botanical center (Fig.1 & 2) was established in Murmansk Region and recording of the flora of the region has continued ever since. During 1953-66 five volumes of “The Flora of Murmansk Region” were published by scientists from the Polar-Alpine Botanical Garden-Institute (PABGI) (Gorodkov, 1953; Poyarkova, 1954, 1956, 1959, 1966). The revision of the orchids was prepared by N.I. Orlova and 16 species in 14 genera were included in the “Flora...” (Gorodkov, 1953). The collections in the Herbarium of the Botanical garden (KPABG) have been formed from various expeditions and include about 500 sheets from the family Orchidaceae. Additional, but quite brief, data on the ecology and distribution of orchids have been published later for the entire Murmansk Region (Ramenskaya, Andreeva, 1982; Ramenskaya, 1983) and in local Floras of the Region (Belkina, et al. 1991; Kostina, 1995; Sokoloff, Filin, 1996). In the 1980s a new publication “Biological flora of Murmansk Region” (Andreeva et al., 1984, 1987, Bubenets et al.1993) began to appear concentrating on rare and endangered species. In one of the issues A. A. Pokhilko (1993) summarised her studies on Epipactis atrorubens.

By the 1980s threats from development by local industry activated the nature protection movement: Red Data Books have been published with ten orchids included in the latest edition (Andreev & Makarova, 1990). This work has been supported by scientists investigating populations of Cyripedium calceolus and Calypso bulbosa in local nature reserves (Vorob'eva & Moskvicheva, 1987; Vorob'eva, et al. 1994). In 1996, as a result of cooperation with Finnish botanists, particularly with Mikko Piirainen, the first data about orchids have been received from the herbaria of Finland. 255 orchid sheets collected in Murmansk Region are kept in the herbarium of Helsinki University alone! Thus, new orchid distribution maps have now been compiled. This work was done first of all for the new edition of the Red Data Book of Murmansk Region which is now in press. Scientists from other Russian botanical institutes have also been studying local orchids. T.I. Vinogradova has been investigating populations of Calypso bulbosa, and the development of Dactylorhiza maculata, Corallorhiza trifida and Listera ovata on the shore of the White Sea (Vinogradova, Filin, 1993; Vinogradova, 1996, 1998; 1999a, b, c, d), whilst Averyanov has critically revised the genus Dactylorhiza from KPABG collections.

Since 1991 orchid studies in the region have been focused on morphology, morphogenesis and population biology (Blinova, 1995a, 1996, 1998a, b, 2000a, b, 2001, 2002) and in 1995 a Ph.D. thesis “Ecological and biological features of orchids from Murmansk Region” was completed (Blinova, 1995b). From 1997-2000 a cooperative project with Utrecht University (The Netherlands) was carried out which aimed to compare populations of Platanthera bifolia and Coeloglossum viride at different latitudes, with emphasis on phenology and population fitness.
over tundra. Only in the northern parts and at higher elevations in the Khibiny and Lovozero Mountains are the coniferous forests gradually replaced by birch forests, dwarf shrub and lichen tundra (Zinserling 1934, Ramenskaya 1983, Koroleva 1994). The mean annual temperature is –1.3°C. The growing season lasts from June to September. The average temperature of the coldest month (January) is –12.7°C and of the warmest month (July) +12.9°C.

Murmansk Region borders Norway and Finland and historically is in the north-eastern part of Fennoscandia encompassing several provinces (Fig. 2).

**TAXA**

Of the 35 orchid genera mentioned in *Flora Europaea* (1980), 15 genera with 19 species, are present in the Region, which may be considered relatively rich for a territory situated almost entirely north of the Arctic Circle (Table 1).

Taxonomic difficulties exist only with *Dactylorhiza* spp. Five species of this group occur in Murmansk Region according to the latest revision of herbarium specimens conducted at KPABG in the 1980s by Averyanov (Komarov-Institute, St Petersburg). They are *D.elodes*, *D.incarnata*, *D.maculata*, *D.meyeri* and *D.psychrophylla*. Two species, *D.traunsteineri* and *D.baltica* were excluded by him in spite of the fact that they had previously been mentioned by other collectors *viz.* M.L.Ramenskaya, N.I.Orlova, I.P.Breslina and A.A.Pokhilko. Averyanov placed several new herbarium specimens, collected as *D.maculata*, under *D.hebridensis*. On the other hand a botanist at PAGBI, V.A.Kostina recognised only three characteristic species — *D.maculata*, *D.fuchsii* and *D.traunsteineri* after making floristic lists from
many different parts of the region (1995, 2001). In northern Europe generally *D. lapponica* seems to be the most common species (Reinhard, 1985). Currently the situation is even more confused following the discovery that, according to DNA-analyses (Bateman, 2001) *D. lapponica* and *D. traunsteineri* are identical. For these reasons a new revision of this genus is now being undertaken at PAGBI. Most orchids from the Region are boreal species with a circumpolar or eurasian range. Only two species – *Chamorchis alpina* and *Leuchorchis albida* – belong to the arctic-alpine element and occur only in Europe. The root-tuber and rhizome life-forms are common amongst orchids growing here. Of the remainder, three species have stem-tubers (*Malaxis, Calypso* and *Hammarbya*) and the other two (*Epipogium* and *Corallorhiza*) possess coralloid rhizomes.

**Distribution**

Information about distribution has been obtained from various sources (Table 1) with the largest set from PABGI. All these orchid species are at the northernmost limit of their distribution area. Only a few of them, e.g. *Coeloglossum viride, Gymnadenia conopsea, Dactylorhiza* spp., grow throughout the entire Region, whilst many others, e.g. *Cypripedium calceolus, Platanthera bifolia, Calypso bulbosa*, reach only central areas here. *Leucorchis albida* has a disjunct distribution. The eastern limit of *Goodyera repens* goes through the central part of the Region. Some orchids have isolated populations outside their main range: *Malaxis monophyllos, Epipogium aphyllum* and *Hammarbya paludosa*.

Temperature is the main factor influencing distribution patterns in the Region. In the spring the south-western areas are warmer earlier than others and in the fall these areas are also relatively warm. That is why most of the orchid ranges extend over those areas. Three patterns of orchid distribution are clearly seen:

1. throughout (species occur with different degree of frequency in the entire Region – five species)
2. south-western (species grow in south-western areas of the Region – eight species)
3. restricted (a combined group from species with an isolated, or disjunct range, and species with the eastern limit of distribution area – four species)

**Ecology**

The natural plant communities of the Region of observation are mainly deciduous forests composed of *Pinus friesiana, Picea obovata* and *Betula callosa* (so-called north taiga type), with *Betula subarctica, Salix caprea* and *Juniperus sibirica* dominating the understory. The herb layer typically consists of herbaceous species such as *Cirsium heterophyllum, Barsia alpina, Potentilla erecta, Deschampsia flexuosa, Geranium sylvaticum, Luzula pilosa, Solidago lapponica, Melampyrum sylvaticum, M. pratense and Chamaenerion angustifolium*, and of dwarf shrubs, especially *Empetrum hermaphroditum, Vaccinium uliginosum, V. vitis-idaea* and *Calluna vulgaris*. Many communities are also rich in bryophytes.

In Murmansk Region many orchids occur in sparse forest habitats with an intermediate degree of light availability and a canopy openness of about 30-50%. The soils are podsols, peaty podsols and peat. Only two orchids are characteristic tundra species – *Chamorchis alpina* and *Leucorchis albida*. A number
Table 1. Orchid species growing in Murmansk Region (north-west Russia) with some of their characteristics

<table>
<thead>
<tr>
<th>Latin name</th>
<th>Area of distribution</th>
<th>Occurrences in the regional provinces</th>
<th>Regional pattern of distribution</th>
<th>Regional frequency of occurrences</th>
<th>IUCN category</th>
<th>Red Book of Russia</th>
<th>Protection required</th>
<th>The number of herbarium specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calypso bulbosa (L.) Oakes</td>
<td>boreal circumpolar</td>
<td>Lim, Kk (?)</td>
<td>south-western</td>
<td>11-40</td>
<td>CR</td>
<td>+</td>
<td>full</td>
<td>KPABG-8, H-7, KSNR-5, LSNR-3</td>
</tr>
<tr>
<td>Chamorchis alpina (L.) Rich.</td>
<td>arctic-alpine European</td>
<td>Lt (?)</td>
<td>restricted</td>
<td>1-10</td>
<td>CR</td>
<td>-</td>
<td>full</td>
<td>-</td>
</tr>
<tr>
<td>Coeloglossum viride (L.) C. Hartm.</td>
<td>boreal circumpolar</td>
<td>Lps, Lt, Lm, Lv, Lp, Lim, Ks, Kk</td>
<td>throughout</td>
<td>&gt;70</td>
<td>NT</td>
<td>-</td>
<td>BioC</td>
<td>KPABG-105, MW-20, KSNR-5, LSNR-15, H-54, OULU-5</td>
</tr>
<tr>
<td>Corallorhiza trifida Chatel.</td>
<td>boreal circumpolar</td>
<td>Lim, Lp, Lps, Lt, Lv, Lm, Kk, Ks</td>
<td>throughout</td>
<td>41-70</td>
<td>VU</td>
<td>-</td>
<td>partly</td>
<td>KPABG-32, LSNR-7, H-20</td>
</tr>
<tr>
<td>Cypripedium calceolus L.</td>
<td>boreal eurasian</td>
<td>Lim, Ks, Kk, Lps</td>
<td>south-western</td>
<td>1-10</td>
<td>CR</td>
<td>+</td>
<td>full</td>
<td>KPABG-5, MW-3, LE-4, KSNR-4, H-1</td>
</tr>
<tr>
<td>Dactylorhiza incarnata (L.) Soó</td>
<td>boreal eurasian</td>
<td>Lim, Ks</td>
<td>south-western</td>
<td>11-40</td>
<td>VU</td>
<td>-</td>
<td>partly</td>
<td>KPABG-8, H-5</td>
</tr>
<tr>
<td>Dactylorhiza maculata (L.) Soó</td>
<td>boreal eurasian</td>
<td>Lim, Ks, Kk, Lm, Lps, Lt, Lv</td>
<td>throughout</td>
<td>&gt;70</td>
<td>NT</td>
<td>-</td>
<td>BioC</td>
<td>KPABG-130, MW-1, LSNR-8, H-24, PZV-4</td>
</tr>
<tr>
<td>Dactylorhiza fuchsii (Druce) Soó</td>
<td>boreal eurasian</td>
<td>Lim, Ks, Kk, Kk, Lps, Lt, Lv</td>
<td>?</td>
<td>&gt;70</td>
<td>NT</td>
<td>-</td>
<td>BioC</td>
<td>KPABG-1, H-5-10?</td>
</tr>
<tr>
<td>Dactylorhiza traunsteineri (Saut.) Soó</td>
<td>boreal eurasian</td>
<td>Lim, Ks, Lm, Lps, Lt</td>
<td>?</td>
<td>11-40</td>
<td>VU</td>
<td>+</td>
<td>partly</td>
<td>KPABG-1, LSNR-1, H-20</td>
</tr>
<tr>
<td>Epipactis atrorubens (Hoffm. ex Bernh.) Bess</td>
<td>boreal eurasian</td>
<td>Lim, Ks</td>
<td>south-western</td>
<td>1-10</td>
<td>CR</td>
<td>-</td>
<td>full</td>
<td>KPABG-8, MW-1, H-2</td>
</tr>
<tr>
<td>Epipogium aphyllum Sw.</td>
<td>boreal eurasian</td>
<td>Lim, Ks</td>
<td>south-western</td>
<td>1-10</td>
<td>CR</td>
<td>+</td>
<td>full</td>
<td>KPABG-3</td>
</tr>
<tr>
<td>Goodyera repens (L.) R. Br.</td>
<td>boreal circumpolar</td>
<td>Lim, Lps, Lt, Lv, Ks, Kk</td>
<td>restricted</td>
<td>41-70</td>
<td>VU</td>
<td>-</td>
<td>partly</td>
<td>KPABG-28, MW-8, LSNR-5, H-13</td>
</tr>
<tr>
<td>Taxon</td>
<td>Subsection</td>
<td>Distribution</td>
<td>Frequency</td>
<td>IUCN Status</td>
<td>Conservation Status</td>
<td>Herbarium Collections</td>
<td>Protection</td>
<td></td>
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</tr>
<tr>
<td><em>Gymnadenia conopsea</em> (L.) R. Br.</td>
<td>boreal eurasian</td>
<td>Lps, Lt, Lm, Lv, Lp,</td>
<td>throughout</td>
<td>&gt;70</td>
<td>NT</td>
<td>KPABG-80, MW-16, LSNR-12, H-32, PZV-3</td>
<td>BioC</td>
<td></td>
</tr>
<tr>
<td><em>Hammarbya paludosa</em> (L.) O. Kunitze</td>
<td>boreal circumpolar</td>
<td>Lim, Kk</td>
<td>south-western</td>
<td>1-10</td>
<td>CR</td>
<td>KPABG-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Leucorchis albida</em> (L.) E. Mey.</td>
<td>arctic-alpine European</td>
<td>Lim, Lp, Lps, Lt, Lv</td>
<td>restricted</td>
<td>41-70</td>
<td>EN</td>
<td>KPABG-23, MW-7, LSNR-12, H-29, OULU-3</td>
<td>partly</td>
<td></td>
</tr>
<tr>
<td><em>Listera cordata</em> (L.) R. Br.</td>
<td>boreal circumpolar</td>
<td>Lim, Lm, Lp, Lps, Lk, Kk, Ks</td>
<td>throughout</td>
<td>&gt;70</td>
<td>NT</td>
<td>KPABG-43, MW-14, LSNR-5, H-14</td>
<td>BioC</td>
<td></td>
</tr>
<tr>
<td><em>Listera ovata</em> (L.) R. Br.</td>
<td>boreal eurasian</td>
<td>Lim, Kk</td>
<td>south-western</td>
<td>1-10</td>
<td>CR</td>
<td>KPABG-3, MW-1, KSNR-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Malaxis monophyllos</em> (L.) Sw.</td>
<td>boreal eurasian</td>
<td>Lim</td>
<td>restricted</td>
<td>1-10</td>
<td>CR</td>
<td>KPABG-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Platanthera bifolia</em> (L.) Rich.</td>
<td>boreal eurasian</td>
<td>Lim, Kk</td>
<td>south-western</td>
<td>1-10</td>
<td>CR</td>
<td>KPABG-4, MW-4, H-1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend to Table 1:

Biogeographic provinces of Fennoscandia (within Murmansk Region and adjacent areas):
- Lm – Lapponia mutmanica, Lp – Lapponia ponjoensis, Lv – Lapponia Varsuage, Lim – Lapponia Imandrae, Lt – Lapponia tuliomensis,
- Lps – Lapponia petsamo_nsis, Lt – Lapponia inarenosis, Lks – Lapponia sampiensis, Ks – Regio kuusamo_nsis, Kk – Karelia keretina


Frequency of occurrences, the scale: 1-10 – rr (very rare), 11-40 – r (rare), 41-70 – str (sometimes rare), >70 – stfq (sometimes frequent)


Protection required: full, or partly (by State), BioC – biological control (by local botanical institutions)
of species – Dactylorhiza maculata, Gymnadenia conopsea, Coeloglossum viride and Listera cordata – occur in both types of vegetation and in the intrazonal communities like bogs with high frequency.

Conservation

The proposed IUCN criteria (IUCN, 1994) were tested for the orchid species occurring in Murmansk Region. Using these guidelines, the species have been placed in five categories: CR, EN, VU, LR, NE (Table 1). The largest number have been placed in the Critically Endangered category and hence require a high degree of protection. The ongoing studies here on population biology aim to provide a scientific basis for the protection of these species at the northern limit of their range.

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