



# Unexpected discovery: an enclave of East-Siberian plants in Northern Europe

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## Abstract

Small native populations of the Siberian dwarf pine *Pinus pumila* (Pall.) Regel and bristle-pointed iris *Iris setosa* Pall. ex Link were discovered recently on Kildin Island located near the Kola Peninsula in the Barents Sea. Both species' records are from a natural landscape, and there is no evidence for their introduction by humans. Kildin Island is 3200 km away from the typical range of the species. The discovery may have remained unnoticed for a long time because the island's interior remained relatively unexplored compared to its seashores. It is a result of a recent conservation assessment of the island as a whole, aiming to reveal habitats of threatened species and other subjects of conservation value. The occurrence of the two species may represent a glacial relict, but a good explanation of their origin is not available so far. This discovery may help to better understand the ecological history of the boreal zone of Eurasia.

**Keywords** Dwarf pine *Pinus pumila* · *Iris setosa* · Kildin Island · European flora

## Introduction

The European flora has been actively studied over the last centuries; therefore, any new contribution to the list of native plants seems improbable. All the more interesting is the discovery of East-Siberian plants in Northern Europe far distant from their current main distribution. Such disjunct occurrences are reported from Kildin Island in the Barents Sea. In 2018, the bristle-pointed iris *Iris setosa* Pall. ex Link was found there, and its natural origin was substantiated (Boltenkov et al. 2020), although the previously known native habitats of this species are located in the East-Siberia, Far East and Alaska. In 2022, I observed these plants and discovered that the Siberian dwarf pine *Pinus pumila* (Pall.) Regel grows nearby as well, which is a neighbour of *Iris setosa* in Eastern Siberia and Far East.

## Study area, methods

Kildin Island has a shape of an elongated spot 17 km long and 7 km wide; its area is 9137 ha. It is separated from the northern coast of Kola Peninsula by a strait about 1.5 km wide. Most of the island is covered with tundra, on highlands up to 200 m above sea level. The island is located along the northern marine route from European countries to Russia, which has been used since the remote past. A base for fishing and hunting existed there from the sixteenth century until it was destroyed in 1809 by British pirates. The base was rebuilt several decades later, a permanent settlement was established there, and its population gradually increased. In the 1920s, there were several dozen permanent inhabitants and more than a hundred visiting workers. The locals dealt mainly with fisheries, hunting and other traditional occupations. The population continued to increase in the 1930s, but the island was arranged for military purposes, and the civil citizens were evacuated to the mainland in 1939–1940. In the 1950s, the human presence grew sharply because of military activities. Several military posts and settlements were established, and the population reached 15,000 people. In the 1990s with the breakdown of the USSR, the settlements were abandoned, and the number of military posts was reduced to a minimum. Since 1995, there has been no permanent population (Ostrov Kildin 2023a, 2023b). However,

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the island was visited by researchers and tourists multiple times. The island is well-known among scientists because it is the site of a meromictic lake (Mogilnoye), i.e. a lake having several non-intermixing layers of different waters. The lake formed from a lagoon, and a specific combination of freshwater and salt-water communities evolved there. This unique feature has been studied since the nineteenth century up to recent times (Knipowitsch 1895; Krasnova 2021). Expeditions of botanists, ornithologists, historians and other specialists also took place there.

The research performed in June 2022 aimed to reveal habitats of threatened species and other subjects representing conservation value (bird colonies, waterfalls, picturesque rocks etc.); as such, the island was crossed several times in different directions. Since the local *Iris setosa* is a rarity, its habitat was also observed (Online Resource Fig. 1). The information on Kildin Island and discovered plant species was specified examining Russian Science Citation Index (2023), Scopus (2023) and GBIF (2023a, b) databases. Moreover, the web sites of the former residents of Kildin were browsed (Ostrov Kildin 2023a, 2023b).

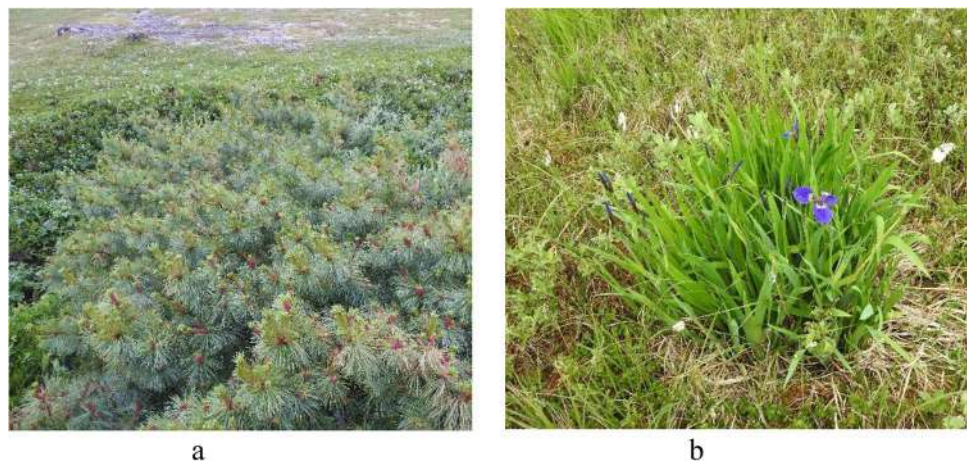
## Results

The discovered Siberian ‘enclave’ is small. The area of habitat of the irises was outlined as 537 m<sup>2</sup> during the first observation (Boltenkov et al. 2020). No other one was found in 2022. The main occurrence of irises is located in a small depression in the highlands (Fig. 1; Online Resource Figs. S2, S3). There are about 500 plants. Moreover, a small number of them occur in a neighbouring depression and along nearby brooks. The dwarf pines grow on a steep slope 200 m away from the irises (N69° 19.654' E34° 17.481'). In total, the ‘enclave’ covers an area of 3 ha. Three dwarf pines were found. They well correspond to the description of this species (Komarov 1934; Tikhomirov 1949): it is a

shrub with creeping branches or, rarely, a small tree up to 5 m high; the needles are in bundles of five; the number of scales of the cones is often less than 20, and the cones are 3.5–4.5 cm long and 2.5 cm wide; the cones develop during 2 years; they are purple during first year and green in the beginning of the second year (Fig. 1, Online Resource Figs. S4, S5, S6, S7, S8, S9, S10). The hybrids of dwarf pine with Siberian pine *Pinus sibirica* have been often reported; they are fertile (Vasilieva 2011). Siberian pine and its cones are usually much bigger; it has one trunk, the violet cones, more than 30–40 scales in a cone (Komarov 1934). The pines of Kildin do not show the characters of *Pinus sibirica*. They look like typical dwarf pines (e.g. from Kamtchatka (Online Resource Fig. S11)). One of the observed individuals had well-formed cones, the other one had first-year cones and the third one, no cones. The first one was 2 m high and the second and third ones were about 1 m. Dried cone was found nearby; it was collected and handed to the herbarium of the Saint Petersburg State University (LECB 0,005,006, Online Resource Fig. S12). The dwarf pines grow in small thickets together with the other small shrubs surrounded by tundra (Fig. 1, Online Resource Figs. S7, S8).

The literature search yielded no information on the introductions of irises and dwarf pines to Kildin, although both plants were often studied. Dwarf pine attracted an especially big attention, as it was considered economically significant. Several specialists proposed to use its ‘nuts’ as a food and the needles as a source of vitamin to resist scurvy. Moreover, the dwarf pine thickets represented interest as a habitat of sable (*Martes zibellina*). Yet in the 1930s, the distribution of dwarf pine was described in detail (Tikhomirov 1949). The north-western border of its native range passed along the shores of the lower reaches of Lena River, i.e. at a distance of 3200 km from Kildin (Fig. 2). The Iris was studied less intensively, but studies focusing on the species were performed, too (Alexeyeva 2008). Known points of occurrence indicate that its

**Fig. 1** The dwarf pine (*Pinus pumila*) (a) and bristle-pointed iris (b) (*Iris setosa*) of Kildin Island



**Fig. 2** The range of *Pinus pumila*: Kildin Island (red circle) and main range (red line) (based on Tikhomirov 1949 and GBIF 2023b)



distribution area in Asia is approximately the same as that of dwarf pine (Alexeyeva 2008, GBIF (2023a, b)). Both iris and dwarf pine are used as ornamental plants. These plants are available in the Polar-Alpine Botanical Garden-Institute on Kola Peninsula 200 km away from Kildin (Zykova and Goncharova 2022). However, a natural spread over surrounding territory was not reported. A recent review on the alien plant species of Kola Peninsula does not contain records of irises or dwarf pines (Kozhin et al. 2020). The former residents of Kildin collected numerous documents about everything related to the island, but neither irises nor dwarf pines were mentioned (Ostrov Kildin 2023a,b). In the other regions out of their native range, both species occur sometimes at settlements, but the number of such plants is very small, and they do not constitute reproducing populations. Such cases are known from the coasts of Kandalaksha bay of the White Sea, which is about 270 km away from Kildin. One iris was found at its southern coast but its origin is unknown. One dwarf pine was reported from Riashkov Island located also at its southern coast. Unlike the iris, its origin was documented: in the 1970s or 1980s, seeds of East-Siberian trees were planted on this island. They germinated, but except for this dwarf pine, all plants died soon after (Kozhin 2014). The other occurrences out of native range are several thousand kilometres away from Kildin. An idea to introduce dwarf pines over big areas in European Russia including Kola Peninsula was discussed in the 1930s (Tikhomirov 1949), but there is no historical evidence on the realization of such projects. The seeds of dwarf pines were planted several times in 1940–1960s Polar-Alpine Botanical Garden-Institute, but unsuccessful. The transplants from native populations also had not survived, only since 1970s after the planting

of several series of seeds of the dwarf pines established in the Garden (Zykova and Goncharova 2022).

## Discussion

Even if it is possible to speculate that the iris was planted recently by someone on Kildin, introduction of dwarf pine by humans seems less probable. The dwarf pine has a long life span, so even small plants can be very old. The ones discovered by me are several decades, or even several hundreds of years old. The dwarf pine is an ‘immortal’ plant; its branches can take root, and even when the initial trunk ages and dies, they can persist for a long time by ‘crawling’ to a new site (Berman and Vazhenin, 2014). Had the dwarf pines been introduced to Kildin, this would mean that in the remote past somebody obtained their seeds or seedlings, then came to the island, climbed up the mountain through a wildlife area, planted them, and then they survived. Similarly, such action would have been necessary to establish the irises, and that would hardly be probable. The above-mentioned attempts to enrich the flora of Riashkov Island and Kola Peninsula show that the introduction of East-Siberian plants into the natural environment of Europe is not a simple thing.

It is likely that the dwarf pines were more numerous in the past on Kildin. According to the reports made in the 1920s (Formozov 1929), the locals actively cut down small trees (birch, willow, rowan) growing on the slopes along the southern coast, and dwarf pine could also have been among the felled trees. Moreover, locals grazed cows, sheep and reindeer and grazing evidently reduced the area covered by arboreal vegetation.

The enclave remained unnoticed for a long time because human activities mainly had been concentrated along the seashores. I conducted a complete conservation assessment of the island. The highlands are featured not only by the plants, but also because the white-tailed eagle *Haliaeetus albicilla* and gyrfalcon *Falco rusticolus* nest there. These raptors are considered protected species in Russia. They like to settle on steep highland slopes, and the dwarf pine also prefers such habitats.

It is difficult to characterize the origin of the enclave. In the case of the iris, the transportation by transpolar current during interglacial periods was discussed (Boltenkov et al. 2020). The irises often grow near water bodies, their seeds can float, and they can be effectively transported by flowing water. However, dwarf pine seeds do not float well. This species does not occur in America, although it is a common species in Chukotka and Kamchatka. Dwarf pine spreads with the assistance of animals: birds and mammals feed on its seeds and store caches in the ground, and some of the unused seeds germinate (a nutcracker, *Nucifraga caryocatactes*, is its main distributor). Rapid spread for long distances by these means is problematic.

The enclave may represent a glacial relict, i.e. consist of remnants of a population having a larger range in the past. The borders of such a ‘Hyperborea’ are not known, but it seems probable that the nearest mainland did not belong to it. The eastern part of Kildin is an independent tectonic block separated by rifts from the others (Mityaev and Korsun 2010). The island differs geologically from the nearest mainland. While Kildin is composed of sandstone and other sedimentary rocks, the mainland consists mainly of granite. Maybe the geological of the island is more related to that of more northern lands. Nowadays, these lands are distant from the mainland, but in the past, there was another situation, as indicated by the distribution of reindeer: reindeer occur in Spitzbergen, and in the past also in Franz Joseph Land, although these islands are separated from the mainland by several hundred kilometres (Vehov 2018). Reindeer are not able to overcome such big distances by sea. This means that land bridges existed in Barents Sea. It may be that the irises and pines will clarify this aspect of geological history, or vice versa; studies of geology may help to clarify the advent of the East-Siberian plants to Europe. For now, we should admit that a good explanation of this ‘biogeographic non-conformity’ is not available.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s00114-023-01850-z>.

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## Declarations

**Conflict of interest** The author declares no competing interests.

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