

Iris Rabbitear *Kasatik* (*Iris*) *laevigata* Fischer et Meyer – distribution features on the north-western border of the area

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Abstract. As a result of special work, it was revealed that the Iris Rabbitear *Kasatik* (*Iris*) *laevigata* Fischer et Meyer is a rare species of the Irkutsk region, the Republic of Buryatia and the Transbaikal Krai. It is shown that until recently, the features of its distribution in the northwestern edge of its area were unknown. Our special long-term research has allowed us to identify it in many parts of this region. It is shown that all his finds are limited to the occurrence of small curtains of this species (2-10 flowering plants, rarely up to 20 and only in two cases 50-70 flowering stems). It has been established that this species is most common on the rivers of the Republic of Buryatia – Upper Angara and Kichera. The most typical stations of the species have been identified - very well-insulated open parts of grass-sedge swamps with separate lakes. It is shown that the main limiting factor for it is the lack of heat at the northwestern border of its area. Here, its distribution is limited by the mountain floodplain water regime. Summer floods coming from the mountains and reaching the strength of large and even catastrophic floods carry very cold waters, strongly depressing the vegetation of aquatic vegetables. It is proved that the conservation of this species can only be ensured by creating a network of differently ranked specially protected natural territories. For species with a local distribution of small parts suitable for their habitat, the organization of Natural Monuments at the republican and federal levels is the most promising.

1 Introduction

The conservation of rare and endangered plant species is the primary task of environmental protection activities of all States. However, solving this problem requires in-depth knowledge of the peculiarities of their distribution and ecology, which is now clearly insufficient for many rare species. This is especially true for rare species with a mosaic or sporadic distribution over a wide area. These species include the Iris Rabbitear *Kasatik* (*Iris*) *laevigata* Fischer et Meyer (famely Iridaceae) on the northwestern edge of the area. Despite many years of research, the features of its distribution in Eastern Siberia are still very poorly understood. This is largely determined by its mosaic distribution. In most of it,

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only individual small curtains (from 1.0 to 10 m²) of this species are known to be found. And only in the most favorable places is its abundance high enough. On the edges of the ancient lakes of the second and third terraces of fairly large rivers, it is part of the leading species among macrophytes. Relatively small (up to several tens of m²) local curtains of this species are found on the steppe lakes of Prebaikal and Transbaikalia.

The Iris Rabbitear is an East Asian rare Red Book species of Russia found in floodplains and wet meadows. It is distributed in the south of the Far East (Primorsky, Khabarovsk Territories, Amur, Sakhalin Regions, Kuril Islands), in Japan, Korea, China and Mongolia. The latter two regions are part of Central Asia. In Eastern Siberia, it is found in the Irkutsk Region, the Transbaikal Territory, the Republic of Buryatia and Sakha (Yakutia) (regions of Central Yakutia and Aldan) [1-9]. Here it is a more common species in its eastern regions, and to the west it becomes rare and is often found only in individual curtains in the most favorable habitats. In the Irkutsk region (the northwestern border of the area), this species is known from herbarium specimens collected in the 1920s in the upper reaches of the Angara River (IRKU funds) [1]. Later collections of this species were not known until recently. Research in recent decades has made it possible to significantly clarify the features of its distribution on the northwestern border of its area, but most of this information has not yet been published. In our work, new materials are provided that make it possible to significantly clarify the features of its distribution in this plot of its area.

2 Materials and methodology

Eastern Siberia is located in the center of Asia, at the junction of steppe and forest zones and is a mountainous country with a large number of plateaus. The mid-mountain relief with heights of 800-1800 m clearly prevails here. The plains do not reach a large area, and the lowlands are rare and small in size. At the same time, there are large mountainous regions here - the Sayano-Baikal Stanovoe and the Khentei-Chikoy highlands, with heights from 2500 m to 3500 m [10]. The entire territory of Eastern Siberia is divided by the Baikal rift zone, running from the southwest (from Lake Khubsugul) to the northeast (left bank of the Olekma River) into two parts. Lake Baikal, which occupies the central, deepest part of the rift, is its central link. This rift is characterized by very high seismicity, with individual earthquakes of 10-11 points. The northwestern part of the territory of Eastern Siberia, adjacent to the lake. Baikal is called Prebaikal, and the south-eastern one is called Transbaikalia.

The northern outskirts of the steppes of Mongolia and China enter the south of Transbaikalia. For these regions, a very characteristic element of the relief is the vast and treeless intermountain basins, through which the steppes can rise high into the mountains. A belt of mountain steppes with a fairly large square is being formed here. The zone of zonal steppes turns into an extensive forest-steppe, characterized by a very high diversity of various landscapes, including, especially on the plateaus and in the middle mountains, extensive forests. In the Prebaikal region there are small steppe and forest-steppe plots found along the Angara River and the lower sections of its large tributaries. On Olkhon Island and in the Priolkhonye region, the steppes occupy a larger area and typical vegetation elements characteristic of the Asian steppes are found in large numbers here [11-12].

In general, Eastern Siberia is characterized by a very well-developed river network, differentiated, with the exception of the Uldza-Torey basin, by high density. It belongs to the basins of the three largest rivers in Siberia: Yenisei, Lena and Amur. The rivers' nutrition is mixed – snow and rain. Island permafrost is widespread here. There are very few large lakes of natural origin and small thermokarst lakes located in the valleys of rivers and springs, as well as lakes derived from the riverbed, are found everywhere [13].

The climate of this territory is moderately continental and sharply continental, but in deep basins it is ultracontinental. The basin of Lake Baikal, due to the huge water mass, is characterized by a seaside climate (mild winters and cool summers). The transfer of air masses from the northwest and warm humid ones from the south (monsoons) prevails, but sometimes cold air flows are observed from the north. The amount of precipitation increases from west to east, but in forest-steppe basins it is less, about 250-300 mm per year [14]. Lake Baikal is characterized by winds reaching gale force, especially in spring and autumn.

In Eastern Siberia, especially in the south of the region, pine forests of various types are widespread. This is determined by the general, rather complex composition of vegetation that forms under the canopy of forests of this type. Quite large areas characterized by high humidity are occupied by larch-cedar and cedar forests. However, pure forests of Siberian stone (cedar) *Pinus sibirica* are more common on the Leno-Angarsk and Prilensky plateaus. To a lesser extent, they are common on the northeastern coast of Lake Baikal and are found here in separate arrays along the slopes of the northern exposures. In the northern regions, pure larch trees are quite widespread. In the floodplains of rivers, forests are formed mainly by Siberian Spruce *Picea obovata* and Siberian Fir *Abies sibirica* with an admixture of Siberian Larch *Larix sibirica* and Dahurian Larch *Larix gmelinii*, as well as Siberian stone (cedar). Floodplains in the upper reaches of rivers and small springs and rivers are almost always occupied by open, often hummocky, sedge swamps, swampy forests or hermes (various types of shrubby birches), especially on permafrost-swamp soils [11].

The work is based on the materials of detailed surveys of the territory of Eastern Siberia throughout the second half of the last and the beginning of the current centuries. Almost all regions of Eastern Siberia have been studied. Mapping of the identified sites of finds of this species was carried out, as well as their detailed description, according to generally accepted geobotanical methods of recording the collected material. However, it should be borne in mind that this refers to large geographical allocations, and this type of plant is characterized by a local distribution with wide development of small bodies of water. As a result, it is impossible to talk about a detailed study of this territory, but the main patterns of distribution of the species have undoubtedly been accurately identified. This allows us to present a fairly complete picture of the distribution of the Iris Rabbitear in the northwestern edge of its area, which is characterized by its very sporadic distribution.

3 Results

The Iris Rabbitear is a perennial plant with a short, thick rhizome. The stems are more than 60 cm tall, but sometimes reaching 2.0 m. The basal leaves are wide, longer than the stem. The flowers are 3-4 in number, large, up to 15 cm in diameter, blue; the outer lobes of the perianth with a short yellow nail. The box is triangular, elongated, without a spout, its inner wall with violet-purple veins. The seeds are brown. A typical wetland plant, it grows along the shores of shallow lakes, old trees, on damp saline meadows, on sedge and grass marshes, sometimes forms thickets. Reproduction is seminal and vegetative. It blooms in July, the seeds ripen in late July – August [3-7, 9, 17, 20].

On Lake Baikal, it is occasionally found along the eastern coast from the town of Slyudyanka to the northern tip of the lake. It was recorded near the town of Slyudyanka, on lakes along the river Vydrina, near the station Posolskaya, in the delta of the Selenga River, on Cape Dulan, Lake Kotokelsky, near the settlement Gremyachinsk, at the mouth of the Upper Angara river, near the villages Chechevok and Dushkachan, about settlement Ust-Barguzin, in the bay of Krutogubskaya. It is also found in the Upper Angara basin (the mouth of the Upper Angara River, Uoyan village), on the left bank of the Vitim River, 28 km upstream from Bodaibo, on Lake Oron and at the mouth of the Amalyk River. It is

noted in the lower and upper reaches of the Khilok River [2, 7, 9, 19-20]. The plant is also mentioned, without specifying the location, as found on the territory of the Baikal National Park [1-7, 9, 17, 19-20].

The species is included in the Red Book of the Irkutsk region, published in 2010, as a vulnerable species. It is also included in the Inventory of Rare and Endangered Plants of the Irkutsk region in 2001, where it was given the status of "a species with a declining population" [1, 3-7, 17, 19-20]. In August 2012, during a detailed survey of the Irkutsk reservoir, new areas of its growth were discovered:

- Irkutsk region, Irkutsk district, the right bank of the Irkutsk reservoir, the mouth of the Talts River, the top of the Taltsinsky Bay. Grass-sedge swamp, flooded with water; depth 20-30 cm. 08.15.2012. 1 curtain.
- Irkutsk region, Irkutsk district, the right bank of the Irkutsk reservoir, the mouth of the Bolshaya Gryaznukha River, the top of Butyrki Bay. Grass-sedge swamp flooded with water; depth 20-30 cm. 08.17.2012. 6 curtains.
- Irkutsk region, Irkutsk district, the right bank of the Irkutsk reservoir, an unnamed bay between Butyrki and Burduguz bays. An unnamed river flows into the top of the bay. A grass-sedge swamp at the top of the bay. 08.17.2012. 3 curtains.
- Irkutsk region, Irkutsk district, the right bank of the Irkutsk reservoir, the mouth of the Burduguz river. The top of Burduguz Bay, a grass-sedge swamp flooded with water; depth 20-30 cm. 08.23.2012. 1 curtain.

The plant forms dense curtains (propagation by rhizomes), sometimes quite large, up to several m²; blooms, bears fruit. A detailed survey of the coast of the Irkutsk reservoir is planned in order to discover new habitats for the Iris Rabbitear.

The Irkutsk reservoir is located in a well-populated area and is available for detailed inspection. However, until now, the finds of this species have not been known here. Meanwhile, this species is found in many areas of the Baikal region, although its abundance is insignificant everywhere. Long-term surveys of the wetlands of the Baikal region allow us to give a more detailed description of the features of its distribution in this region.

This species is most common on the eastern border of the Republic of Buryatia (Northern Baikal). The site of its most widespread growth was discovered by us in 1983, 20 km upstream from the village Uoyan. The species is practically not found in low-lying plots in the area of the division of the main riverbed into separate numerous channels, but is common and in places numerous on floodplain terraces and high islands inside this section of the Upper Angara River valley. Here it grows in bulk on the separated channels of the Upper Angara and Kichera rivers, which have turned into almost closed lakes that have a connection with the main riverbed only during the years of catastrophic floods. Typical stations are very well-insulated open plots of hummocky grass-sedge swamps, among which there are individual lakes, as a rule, along the dried-up bed of old channels.

On many lakes located on the terraces of the Upper Angara River, the Iris Rabbitear forms a solid border along the coastal edge. The lakes are quite shallow – up to 1.5 m., but there are areas up to 3.0 and even 5.0 m deep. At the water's edge, the thickets are the most dense, almost continuous, but closer to the root shore they thin out and the Common Bog Bean *Meanthemum trifoliata* begins to mix with them, which forms a continuous raft, very often rooted to the bottom of the lake. Common Reed *Phragmites australis* are very rare here and do not reach large sizes, but, nevertheless, they occur in several elevated plpts with lake-like well-warmed lowlands. The width of the border of the Iris Rabbitear in places can reach 10.0 m., but the densest thickets are formed along the edge of lake beds (usually floats) with a width of 1.0-1.5 m.

The underwater overgrowth of such lakes with aquatic vegetation is very abundant and often almost continuous. It is represented by the Bladderwort *Utricularia vulgaris*, the Claspingleaf Pondweed *Potamogeton perfoliatus*, and the Eurasian Watermilfoil

Myriophyllum spicatum. On the coastal muddy areas, the Marshpepper Knotweed *Polygonum hydropiper*, Water Smartweed *P. amphibium*, and Pale Persicaria *P. lapathifolium* are marked by separate mounds. Swamp Horsetail *Equisetum fluviatile* is found everywhere in low-lying areas, which is very common in flooded hummocks. On fresh, recently exposed mud as a result of drying, there are small dense thickets of the Common Mare's-tail *Hippuris vulgaris*.

On high islands between the numerous channels of the Upper Angara River valley, usually along small channels of the third order that have separated from the main channel, small lakes with a well-defined border of Iris Rabbitear are also common. The floats here are very narrow, up to 3.0-4.0 m of Common Bog Bean and Common Cat-tail *Typha latifolia* and, as a rule, rooted to the bottom of the lake. On many lakes along the water's edge, a Iris Rabbitear grows here in a narrow strip up to 1.0 m or in separate small kurtins. These areas obviously separated from the main channels not very long ago and, with high spring floods or strong summer floods, they connect to the main channels of the Upper Angara River. Probably, that is why the abundance of the Iris Rabbitear is much lower here, compared with the red plots of the Upper Angara River.

In the main territory between small channels that have separated from the main channel of the Upper Angara River, this species is very rare and occurs in curtains of different sizes in curbs on open water beds, among tussock and sedge swamps adjacent to the terraces of the main riverbed. The downstream the surveyed section of the river is, the lower the abundance of this species, and in the delta of the Upper Angara and Kichera rivers its finds are rare [7, 9, 17, 20].

In other plots along the northwestern edge of the area, the Iris Rabbitear is found only in separate kurtins and small, often sparse, thickets. In addition to the above-mentioned sites of his finds, there are known encounters of this species in the Prisayanye (up to the floodplain of the river Iya, Tulunsky district of the Irkutsk region) and along the lakes of the wetlands of the Irkutsk-Cheremkhovskaya plain. Here it was discovered by us in the Buruchok tract, a bowl-shaped swampy basin at the top of the Alka River (Kuytunsky district of the Irkutsk region). Small curtains of the Iris Rabbitear (up to 5.0 m²) were found here in areas with very weak rafting around small open water windows. To clarify, small curtains are formed by 5-10 flowering plants. In addition, a window of open water surrounded by flowering thickets of this species was found in a small swamp at the top of the source flowing into this swampy basin. In the floodplain of the Alka River (beyond the Buruchok tract), small curtains of the Iris Rabbitear are found along small lake-like extensions of this river, up to the village of Salket, and possibly lower.

Small curtains of 10-12 flowering stems were found on the left swampy and muddy open bank of the small forest-steppe river Yelnik between the villages Buruk and Barluk. Here, among the tussocks, small lakes have been preserved, on which this species occurs. Three curtains of 20-30 flowering plants were found in the marshy Zhuravlinka tract (near the village of Brody) and several curtains on small lakes of the Dry River source flowing from this tract. On the large floodplain lakes of the left bank of the river Oka very small curtains of this species are also occasionally observed between the village of Barluk and Barluk Lake. They are somewhat more common on the high terrace of the river Oka is in the lake system, consisting of several large lakes, including the Sun Lake, near the former village of Borovoye. One large curtain of the Iris Rabbitear was found in a swampy area with small lakes in the floodplain of the Kada River near the village of Khairyuzovka. The main part of these locations belongs to the Kuytunsky district of the Irkutsk region, where the northwestern border of the areas of this species passes. Further, only isolated encounters of the Iris Rabbitear are known, and this boundary, depending on the dynamics of the climate, pulsates strongly.

Further west, this species was discovered by us at the top of the bay of the Bratsk reservoir, which flooded the lower section of the Iya River (Tulunsky district, Irkutsk region). The number of species here is also small – several small curtains in shallow water. Further north, in the Chunsky district of the Irkutsk region, the Iris Rabbitear was found on several large lakes in the floodplain of the Chuna River (Lake Kamennoye and its surroundings) relatively close to the border with the Krasnoyarsk Territory. Further north, finds of this species are known only from the lake Oron and the mouth of the Amalyk River (Vitim Reserve) [9, 20]. It is likely that there are areas with the habitat of this species between these two areas. However, undoubtedly, we can only talk about the sporadic spread of the Iris Rabbitear here.

In the Prisayanye, the number of this species is also insignificant, although in places it is found here, both along flat swampy rivers and small lakes in the floodplains of these rivers. Its finds are most common along the border of the Prisayanye and the Irkutsk-Cheremkhovskaya plain, here it is found on small lake systems and on floodplain meadows of small swampy rivers. We found it in a swampy meadow used for haymaking, in the vicinity of an abandoned village in the lower reaches of the Shelbey River. It was most often noted by us in the middle reaches of the Zima River and small rivers flowing into it on the territory of the Zulomaisky hunting reserve. Small curtains of the Iris Rabbitear were found here in the lower reaches of small rivers flowing into the Zima river - Tagna, Bashir, Bolshoy Odoy rivers, as well as in the middle reaches of the Maly Odoy River. At the top of the Tagna River, we found it on a steep, difficult-to-pass swamp (three small curtains) on a section of a small source dammed by a beaver dam. In the basin of the Chernaya Tagna River in the lower reaches, a small curtain of this species was found on a small lake among a swamp.

The next habitat of the species is located in the basin of the Iya River. Here, in the swampy meadows along the border of the forest-steppe and the Prisayanye, there are curtains of this species on several fairly large lakes. Further upstream, in the area of the confluence with the Iya River, the Kirey River (the vicinity of village Vladimirovka) on the lakes there are also small curtains of the Iris Rabbitear. In the basin of the Kirei River (Kirei Beaver Reserve) in its upper reaches, 5 small curtains of this rare red book species were found in swampy meadows. In the floodplains of small rivers and swampy source of the Kirey River basin, small curtains of the Iris Rabbitear are also found on lake-like extensions formed among swamps and swampy meadows. In one case, a sparse border of plants of this species was formed on an widening of the riverbed about 150 m long. It should be noted that all such sites were characterized by increased insolation due to the large area of open wetlands in floodplains of rivers and springs. In all cases, small curtains consisted of 7-10 stems of the Iris Rabbitear, but sometimes very rarely, up to 20 stems and only in two cases they reached the size of 50-70 adult flowering plants.

4 Discussion

A detailed analysis of the findings shows that the main limiting factor for the Iris Rabbitear is the lack of heat at the northwestern border of its area. It is clearly a thermophilic species and is found in fairly large open and well-warmed areas of lakes and swamps. Its distribution is clearly limited here by the mountain floodplain water regime, characterized by high but short spring floods and several summer floods, sometimes reaching the strength of large and even catastrophic floods. Floods coming from mountainous areas carry very cold waters, strongly depressing the vegetation of aquatic vegetation. It is they who limit the distribution of such rather thermophilic species as Common Cat-tail, Narrowleaf Cat-tail *Typha angustifolia*, Graceful Cat-tail *T. laxmannii*, Iris Rabbitear, Blood-red Iris *Iris sanguine*, Common Reed and Great Bulrush *Scirpus tabernaemontani*. It is because of this

that the Iris Rabbitear in the more eastern parts of its area reaches a high abundance in the reservoirs of above-flood terraces that have emerged from the influence of cold flood waters in the summer.

It occupies wetter habitats compared to another species, sometimes found on the northwestern border of its area - the Blood-red Iris [18]. It is well known that any species uses the most optimal habitats at the border of their areas. The Iris Blood-red is found in fairly moist, but higher plots of floodplain meadows. We have not found it among the water or in flooded habitats, although it is quite possible to find it in such places, but this is the result of summer fluctuations in water levels as a result of rains and floods. Normally, he uses moist, but higher plots of swampy or waterlogged meadows [18].

The Iris Rabbitear prefers wetter habitats and very often occupies lake edges, forming, often together with Cat-tails, Common Bog Bean and Purple Marshlocks *Comarum palustris*, border overgrowths on sufficiently strong floats. It is in such plots that its curtains are most often found among the wetlands of Eastern Siberia, often far enough from the water's edge (Irkutsk reservoir). This species is also common among the shallow waters of lake systems, but only near the shore, and its curtain is absent in open water in Eastern Siberia. At the same time, it is common in flooded grass-sedge, with an admixture of different species of Horsetails, swampy meadows.

Restoration of the abundance and habitats of rare and endangered plant species is a priority task of environmental science [8, 15-16]. This is especially important for species of great importance for medicine – medicinal plant species. However, beautifully flowering species are also important for creating a base of plants cultivated by humans and used for recreational purposes. The Iris Rabbitear served as the basis for the breeding of many beautifully flowering cultivated forms of domestic plants. And the preservation of its wild populations is an important task, the solution of which will allow you to breed other beautifully flowering forms, as well as have a basis for breeding new forms resistant to various diseases in different parts of its natural area.

In the conditions of the current strong warming of the climate, there are diversely directed trends in changes in the areas of many specially protected species. Some of them are beginning to expand their areas, primarily steppe plant species (drought-resistant species), while others, on the contrary, are reducing their areas and numbers. Orography of the region plays an important role in this process, since in difficult conditions of mosaic relief local conditions can be created that are favorable for experiencing harsh periods by many rare plant species [8, 15-16]. The Iris Rabbitear is a water-loving plant and the general desiccation of the territory plays an important role in its distribution at the border of the area [8]. Therefore, the preservation of his groupings here is of great importance. At the same time, we do not know the capabilities of the species associated with experiencing long dry periods. Perhaps its seeds and rhizomes can retain their germination for a long time while at rest. In this case, an inventory of the sites of his finds in the period preceding the droughts will also resolve this issue. In this regard, our work is undoubtedly of great importance.

In such conditions, it is important to develop new forms of habitat protection for rare and endangered plant species. In our opinion, the creation of a wide network of different-ranked Specially Protected Natural Territories has the greatest prospects [15]. For species with a local distribution of small plots suitable for their habitat, the most promising Natural Monuments are those with regional and federal status. For extremely rare and small-numbered species, a federal level of protection is necessary, and for more common ones, a regional level is sufficient. All of them play a temporary role in preserving small plots of the species' area and are created as necessary during periods unfavorable for the habitat of protected plants. Namely, the creation of a network of differently ranked Specially Protected Natural Territories, taking into account the species composition of protected

species, will allow us to develop a framework of necessary protected areas that ensure the preservation of diversity and maintain the number of rare, small and endangered plant species.

Such a network of protected areas will make it possible to successfully preserve, first of all, species with a pronounced local distribution over a vast territory. There are indeed many such species, especially among plants living in the coastal zone of reservoirs. Therefore, only a sufficiently extensive network of special protected areas will solve the problem of conservation of such species.

5 Conclusion

The Iris Rabbitear, as well as its other closely related species, Iris Blood–red, need special protection on the northwestern border of their areas, which is characterized by their sporadic distribution. However, the organization of their special protection is a rather complicated matter. It is impossible to create a specially protected area of high rank for the conservation of these species. A special selection of sites is needed where the maximum possible number of species with such a level of rarity and distribution occurs. This greatly complicates the task of protecting them. At the same time, for the sake of their protection, it is quite possible to organize Natural Monuments, including those of federal significance, with the assignment of the task of protecting them to the owners of such lands. Only a special, well-thought-out network of protected areas of different ranks, complementing each other, allows us to solve the problem of protecting such species. Therefore, this is a completely solvable problem that requires only increased attention to the finds of species of this level of rarity and distribution.

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