DINARIDS IN SEED BANKS

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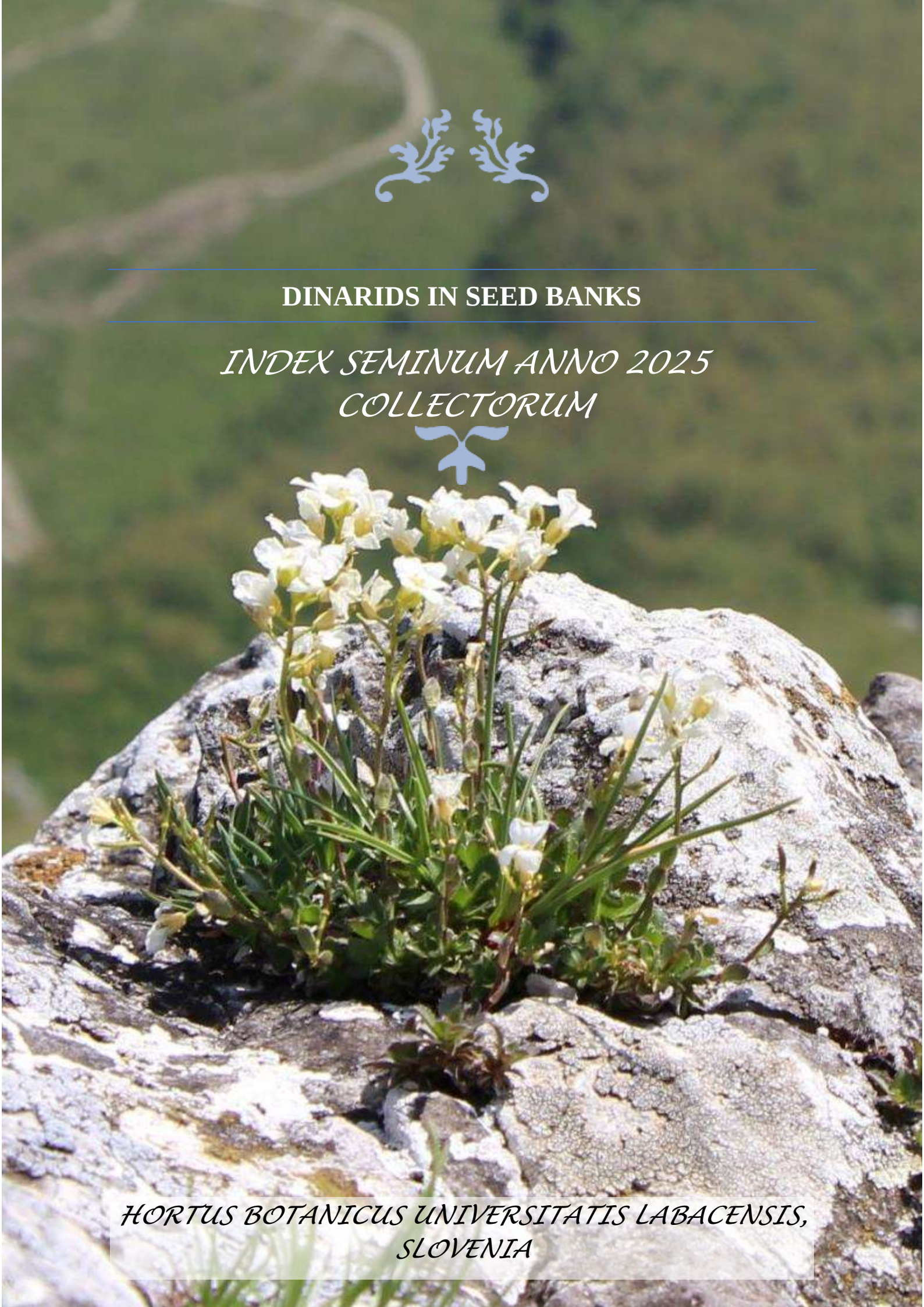

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DINARIDS IN SEED BANKS

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SEED CONSERVATION IN DINARIC ALPS – The Alpine Garden Society fund

Blanka Ravnjak & Jože Bavcon

1 INTRODUCTION

In 2025, precisely when the Millennium Seed Bank was celebrating its 25th anniversary, an opportunity arose to once again remind the scientific, professional, and wider public of the importance of seed banks. In the face of constantly changing environmental conditions and the ongoing threat to biodiversity, seed banks may represent the last refuges of plant species, while at the same time serving as institutions dedicated to their conservation.The establishment of local seed banks is of exceptional importance, as the stored seeds of plant species remain closest to their place of origin. Local researchers are also most familiar with biodiversity-rich areas, local flora and their specific characteristics, as well as the distribution ranges of species in their own environments. All of this enables the most effective protection of plant species. Additional safeguarding of plant species can, of course, be achieved by storing the same seed collections in different seed banks. In this regard, the Millennium Seed Bank stands out, as its capacities provide optimal conditions for long-term seed storage. It not only ensures the preservation of seeds but also, through its experts and scientists, offers support to other seed banks. It is also an institution engaged in seed research and in sharing its findings with other organizations. Nevertheless, it should not be overlooked that each seed of a given species stored in multiple seed banks—not only in the Millennium Seed Bank—is thereby more securely safeguarded. This highlights the importance of cooperation among different seed banks, as well as partnerships specifically aimed at supporting seed collection for plant conservation purposes.

Among the societies actively involved in plant conservation is the Alpine Garden Society from United Kingdom. It is one of the largest horticultural societies, whose members are united by their love of alpine plants and their cultivation. The society organizes various events and exhibitions related to alpine plants and supports the training of alpine plant specialists. It is also active in seed exchange and in organizing field excursions. One of its main objectives is nature conservation; alongside its own conservation activities, it also financially supports other institutions engaged in plant conservation. For this purpose, the Society offers co-funding opportunities for various conservation projects. In 2025, the Botanical Garden of the University of Ljubljana applied for such funding with the project Seed Conservation in the Dinaric Alps. The society recognized the project as significant and approved funding in the amount of £5,000. Through the co-financing of the project, the Botanical Garden of the University of Ljubljana gained the opportunity to expand its seed collection of Dinaric plant species in its seed bank. The Dinaric region is renowned for its rich species diversity and yet remains relatively underexplored.

1.1 Project Introduction

Given the rich floristic composition of the Dinarides, it is therefore expected that a large proportion of plant species from this region is represented in the living plant collection of the Botanic Garden of the University of Ljubljana, as well as in its seed bank. However, due to the vast extent of the area, many plant species are still not represented in the collection, nor are

their seeds stored in the long-term seed bank. For this reason, targeted research and fieldwork are highly desirable to address these gaps. Within the framework of the Alpine Garden Society Fund, we thus had the opportunity to carry out more intensive collection of seeds of Dinaric plant species. The collected seeds will be stored in the long-term seed bank of the Botanic Garden of the University of Ljubljana, which represents an ex-situ conservation possibilities and provides a basis for potential reintroduction or reinforcement of species in the case of their disappearance from natural habitats.

The Dinaric Alps cover roughly one-fifth of Slovenia and nearly the entire Illyrian province (Koljanin et al., 2025), making them one of the most important phytogeographical regions of this part of Europe. Estimates suggest that the entire Dinaric area is home to approximately 6,500 plant species, which also positions the region as a potential biodiversity hotspot in Europe. Of these, 2,600–2,700 species are endemic to the Dinarides (Horvat et al. 1974, Kryštufek in Reed 2004, Stevanovič et al., 2005, Frajman et al., 2014), and at least 250 of them are considered important sources of various bioactive compounds with medicinal applications. Despite this richness, the area remains insufficiently studied, and many of its species are often underrepresented in global plant databases. The limited research is partly due to historical political events in some of the former Yugoslav countries, which caused a halt in field investigations of plant biodiversity. Only after political stabilization did opportunities for research and scientific collaboration with other European countries re-emerge. Slovenia has played a significant role in this context, acting as a transitional and connecting country between the former Yugoslav states and the present European Union. Consequently, University Botanic Gardens Ljubljana has actively collaborated for many years with the Botanic Gardens in Zagreb and Belgrade, through staff exchanges, joint projects, and the sharing of institutional expertise. The University Ljubljana has a long-standing tradition of seed collection and storage in its seed bank and is a member of the Ensconet seed bank network. It is therefore not surprising that the Dinarides, stretching across most of the Balkan, provide an excellent platform for collaborative research and institutional cooperation. Support from the Alpine Garden Society fund allowed us to supplement our seed bank with species native to the Dinarids.

2 METHODOLOGY

2.1 Area description

The Dinarides covering as much as 25% of Slovenia’s territory. They extend across the southern and southeastern parts of the country, stretching in a northwest–southeast direction. The Dinaric mountain range continues beyond Slovenia’s borders into Croatia, Serbia, Bosnia and Herzegovina, Montenegro, Kosovo, and Albania. The Dinarides are in fact divided into three parallel belts: the coastal (southwestern), central, and northeastern belts. The coastal belt of the Dinarides is composed mainly of limestone, with occasional occurrences of flysch. While the central belt is built of limestone and dolomite, the northeastern belt consists of sediments of the Pannonian Sea (https://www.dinarskogorje.com/division-of-the-dinaric-alps.html). A characteristic feature of the Dinarides is the presence of numerous karst plateaus above which peaks, ridges, and crests rise. In Slovenia, the most extensive Dinaric plateaus include the Trnovo Plateau, Hrušica, Nanos, the Idrija Hills, the Javorniki Mountains, the Snežnik Range, the Kočevje–Ribnica Hills, and the Krim–Rakitna Plateau (Wraber, 1960; Kordiš, 1993). This terrain is predominantly composed of Cretaceous limestones with rare intercalations of

dolomite, Jurassic carbonate rocks, and to a lesser extent Upper Triassic rocks (Kordiš, 1993). Due to their limestone–dolomite composition, the Dinaric landscape is shaped by various karst features (caves, sinkholes, dolines, uvalas, collapse features, etc.) (Lovrenčak, 2004; Mihevc et al, 2010). The diverse geological substrate of the Dinarides also results in a variety of soils, including colluvial soils, rendzinas, brown calcareous soils, and leached brown calcareous soils (Kordiš, 1993, Vrščaj et al., 2017).

In addition to tectonic characteristics, the biodiversity of the Dinarides is also influenced by climatic conditions. In the Dinarides, the sub-Mediterranean climate meets the temperate continental climate of western and southern Slovenia (Ogrin, 2004). The interaction of these two climate types results in high precipitation levels, with a pronounced autumn maximum and a less distinct spring maximum. While average annual precipitation in the central belt of the Dinarides ranges between 1,400 and 3,500 mm, the amount is significantly lower in the southwestern belt (Kordiš, 1993), resulting in frequent and prolonged summer droughts. The central belt of the Dinarides is also characterized by a thick snow cover, which can persist well into spring on the northern slopes of Dinaric peaks. The high precipitation in this area is crucial for the successful development of dense Dinaric forests. Significant temperature differences also occur between the central and southwestern belts. The average annual temperature in the central belt ranges from 5 °C to 8 °C and decreases with increasing altitude. This area is also characterized by temperature inversions in doline and valleys, resulting in vegetation inversion. Among weather phenomena, ice storms and wet snow are common and often cause tree breakage and windthrow. During the summer months, windthrows may also occur as a result of strong southwesterly winds (Kordiš, 1993; ARSO, 2006). In the coastal belt of the Dinarides, the average annual temperature ranges from 11 °C to 14 °C. The average temperature of the coldest month in this area is always above 0 °C, while that of the warmest month exceeds 20 °C.

As already mentioned, the areas of the Dinarides in Slovenia with the highest precipitation are covered by continuous fir–beech forests (Omphalodo-Fagetum). Dinaric fir–beech forests are distinguished by a rich floristic composition as well as high vegetation and ecological diversity (Puncer, 1980). They are also included in the Natura 2000 network (Skoberne, 2004). Studies of their biodiversity have recorded as many as 400 different plant species (Dakskobler, 2000; Surina, 2013). In the coastal belt of the Dinarides, plant communities containing thermophilous tree and shrub species such as *Quercus pubescens*, *Fraxinus ornus*, *Cotinus coggygria*, and *Ostrya carpinifolia* are present, while in the warmest areas *Carpinus orientalis* and *Prunus mahaleb* also occur. Between forested areas and at higher altitudes, species-rich grasslands are widespread. Species diversity is particularly high on karst plateaus, where four main floristic geoelements intersect: Mediterranean, Illyrian, Alpine, and European. Within the Mediterranean geoelements, eu-Mediterranean, sub-Mediterranean, Mediterranean-montane, Pontic-Mediterranean, and eu-Mediterranean elements can be distinguished (Kaligarič, 1997). The area is also rich in numerous endemic species, such as *Campanula marchesetti* subsp. *marchesetti*, *Hladnikia pastinacifolia*, *Iris sibirica* subsp. *erirrhiza*, and *Moehringia tomasinii*. Some species (*Arabis scopoliana*, *Pedicularis friderici-augusti*, *Genista sylvestris*, *Inula hirta*, *Micromeria thymifolia*, *Tragopogon dubius*) even have their classical localities in this region (Kaligarič, 1997). Owing to its rich plant diversity, the Dinarides have long been a focus of floristic research. As early as Ioannes Antonius Scopoli (1723–1788), the flora of this area was studied, and many species were first described from here, making the region their *locus classicus* (Praprotnik et al., 2023). Due to extensive forest stands, many studies have focused on forest communities of the region (Marinček, 1987; Kordiš, 1993), the dynamics of the *Omphalodo-Fagetum* community (Kordiš, 1977; Ficko et al., 2011; Ravnjak et. Al., 2023), and

the phytogeographical characteristics of Dinaric beech–fir forests (Bončina et al., 2002; Dakskobler, 2000; Surina, 2013). More intensive botanical research on the vegetation of dry grasslands in the coastal part of the Dinarides began in the early 20th century. This research also included plant communities of various grassland habitats, such as weed vegetation, trampled and ruderal vegetation, doline vegetation, rock vegetation, vegetation of rock crevices, and others (Kaligarič, 1997).

2.2 Description of locations

Seeds were collected at seven areas in the Republic of Slovenia (Nanos, the Trnovski gozd Plateau, Kočevsko, the Karst Edge, Planina Polje, Sabotin, Snežnik, Senožeče, Dragonja, Podgorje) and at one area in Croatia. Within each area, seeds were collected at several different sites (location map). The collection areas were selected to cover the Dinaric part of Slovenia as comprehensively as possible (Wraber, 1969). Below is a description of the individual areas and specific collection sites.

2.2.1 Trnovski gozd Plateau

The Trnovski gozd Plateau represents the boundary of the sub-Mediterranean phytogeographical region. It extends across the northwesternmost part of the Dinarides and at the same time forms a transitional zone between the Dinarides and the Alps. Its surface area is approximately 120 km², measuring about 25 km in length and between 5 and 10 km in width. The elevation of the plateau ranges from 800 to 1,400 m a.s.l. In its central part rises the Golaki ridge, with several prominent peaks: Veliki Golak (1,481 m), Srednji Golak (1,465 m), and Mali Golak (1,495 m). This highest terrain was covered by a glacier during the last glacial period. Due to its rugged relief, this karst plateau is divided into several morphological units, such as mountain ridges and depressions. The Trnovski gozd Plateau is built mainly of Mesozoic limestones and dolomites, while on its southern and western margins it is thrust onto flysch rocks. At the contact between limestone and dolomite with flysch, scree and slope breccias prevail. Soils in the Trnovski gozd area are shallow, skeletal, and rocky calcareous soils with rendzinas. Soil depth is highly variable, with the deepest soils occurring in pockets between rocks and boulders. Several larger frost hollows are also present, which are characterized by vegetation inversion. The ruggedness of the Trnovski gozd area also strongly influences wind conditions. Bora winds prevail, while strong, cold, and dry northerly winds occur somewhat less frequently. Warm and humid southwesterly maritime winds are also common and bring precipitation. Sub-Mediterranean, Dinaric, and Alpine floristic elements intersect on the Trnovski gozd Plateau. The plateau is mostly covered by forests, interspersed with dry grasslands, some of which are used for grazing.

The plateau is predominantly covered by the climazonal Dinaric fir–beech forest association (*Omphalodo-Fagetum*) At lower elevations on southern exposures, black hornbeam and hop-hornbeam forests (*Seslerio-Ostryetum*) occur. Above these, between 800 and 1,100 m, the sub-Mediterranean beech forest (*Seslerio-Fagetum*) is widespread. At slightly higher elevations, between 1,000 and 1,300 m, fir–beech forests dominate. Above them lies the highest forest belt, the subalpine beech forest (*Polystichio- dinaricum*), which reaches up to 1,450 m a.s.l. At similar elevations, the Dinaric maple–beech forest (Stellario-Fagetum *dinaricum*) can also be found. Together, these two associations form the forest line, above which the subalpine belt of dwarf pine (in *Rhodothamno-Pinetum mugo*) develops. On a smaller scale, thermophilous beech forests (*Ostryo-Fagetum*), remnants of Scots pine–*Genista* communities (*Genisto-*

Pinetum), *Lonicero caeruleae-Piceetum* and *Stellario montanae-Piceetum* (Zupančič, 1999) are also present in the Trnovski gozd area.

On the Trnovski gozd Plateau, seeds were collected at five locations: Čaven, Kucelj–Čaven, Kucelj, Otlica, and near Hrušica. The Čaven site is located on an exposed ridge above the valley and represents the southern edge of the Trnovski gozd Plateau. Seeds were collected mainly from Illyrian sub-Mediterranean grasslands. The terrain has a slope of about 30%, and steep rocky cliffs occur below the grasslands. The ground is rocky and locally scree-covered, with shallow soils on a limestone bedrock. The exposure is southeastern, exposed to both sunlight and bora winds. At this site, along the forest edge, the only confirmed Slovenian locality of a hybrid between two rose species, *Rosa spinosissima* and *Rosa pendulina*, has been recorded to date. As both species grow in close proximity, natural hybridization has occurred. In Slovene, this hybrid has been named the Čaven rose, after Mount Čaven (Kunc et al., 2022). The Kucelj–Čaven site is a mountain trail leading from the mountain hut below Modrasovec to the summit of Kucelj. The trail runs along the southern side of the plateau, where forest, forest clearings, and dry grasslands alternate. Seeds were collected mainly in forest clearings and dry grasslands. The Kucelj site itself is a 1,239 m high peak covered by grassland vegetation. Below the summit, both on the southern and northern slopes, there are pastures used for cattle and small livestock. The terrain is rocky, and species with South Alpine and Balkan distributions, as well as Illyrian and Central European species, occur among the rocks. A distinctive feature of Kucelj is that the so-called Humboldt boundary runs across its summit, sharply separating phytogeographical regions (Bavcon and Ravnjak 2022). On the southern side of the peak, sub-Mediterranean plant species are present, while Alpine species occur on the northern side, with only a few meters separating their distributions. The fourth collection site was Otlica, which comprises dry grasslands among pastures near the village of Otlica. Seeds were collected along the path leading to a rock outcrop above the Vipava Valley and on nearby pastures. The site has southern and southeastern exposure and is also exposed to bora winds. The terrain is karstic, with numerous rocks scattered across the grasslands. The site near Hrušica is located along the main road that runs through fir–beech forest across the Trnovski gozd Plateau. It is a small patch of grassland with southern exposure and a slope of about 30%, which is already undergoing with shrub overgrowing.

2.2.2 Nanos

Nanos is also a karst plateau that adjoins the Trnovski gozd Plateau. It is 12 km long and 6 km wide and is composed of Cretaceous and Jurassic limestones. The steepest and most precipitous slopes are found on its eastern, western, and southern sides, where elevation differences reach up to 700 m. Toward the north, the plateau becomes more gently sloping. Due to karstification processes, the relief of the plateau is shaped into dolines, shafts, caves, and conical hills. The Dinaric and sub-Mediterranean vegetation zones intersect on the plateau, with Alpine influences also present on the northern side. As a result, Illyrian, Alpine, and Mediterranean species all occur here. The plateau is mostly covered by beech forests and fir–beech forests, while sub-Mediterranean–Illyrian black hornbeam forests with autumn moor grass (*Seslerio autumnalis–Ostryetum*) occur on the southern, sun-exposed, rocky slopes (Kaligarič, 1997a). A large part of the plateau is also covered by grasslands and pastures, which are becoming overgrown due to the abandonment of grazing. Owing to its rich flora and fauna, an area of 2,632 ha on the southern and western margins has been protected as a landscape park since 1987.

Within the Nanos Plateau area, seeds were collected at five locations. The first site, Rajske poljane, is located at the beginning of the Nanos Plateau. It is an exceptionally biodiveristyrich dry grassland with southern aspectand a slope of about 30%. On its western and northern edges, the grassland is already overgrown with shrubs. The second site, Planšarska koča, is located at a small pass leading toward the highest part of the Nanos Plateau. It is a flat area with several small dolines, covered by dry grasslands. This area is also starting with owergrowing process with shrubs and trees along its margins. The third site, Plato Kapelica, consists of dry grasslands on a slope extending toward the peak of Mt. Nanos. The site has southern exposure and is frequently exposed to bora winds. Small dolines are also present. The fourth site, Plato Preval, is located approximately 3 km before the peak of Mt. Nanos. It is a small valley with predominantly dry grasslands in front of the forest. Seeds were collected both on level grasslands and on slopes. The fifth site is located directly on peak Mt. Nanos. While the southern side of the peak is markedly overhanging, with steep cliffs, the northern and northwestern sides are gentler. The peak of Nanos is extremely rocky, with large stones and scree among which dry grasslands occur. Soils are very sandy and shallow. Seeds were collected across the entire peak area, both from grasslands and from rocky substrates.

2.2.3 Snežnik

Snežnik is the highest peak (1,796 m) of the Slovenian part of the Dinarides. It is composed of limestone, dolomite, and limestone and dolomite breccias. Its central part rises prominently above the more gently sloping surrounding terrain and, due to abundant precipitation and high elevation, remains snow-covered late into spring and already from early autumn. The peak itself is rounded, while its slopes are characterized by dolines, collapse dolines, and shafts with steep rock walls. Snežnik is connected by a mountain ridge to Mali Snežnik. Due to the pronounced karstification of the area, surface water sources are scarce on Snežnik. The soils are brown calcareous soils, shallow and highly skeletal, on which brown rendzinas have developed. As

already mentioned, Snežnik is characterized by high moisture levels, with the greatest amount of precipitation occurring between October and December and the least in July and August. The prevailing winds are the bora and southwesterly winds, which bring precipitation. Snežnik has a Dinaric–continental climate. On Snežnik, Alpine and western Balkan floristic elements intersect. Some Alpine plant species reach their southeastern distribution limit on Snežnik, while some Balkan species reach their northwestern distribution limit here. The Snežnik range is also characterized by the occurrence of true Illyrian species, i.e. species predominantly distributed in the Dinarides (Čeligoj, 2000).

Seeds in the Snežnik range were collected from the mountain pass where the forest line transitions into dwarf pine (*Pinus mugo*) scrub, along the hiking trail through the dwarf pine belt and across the connecting ridge between Mali Snežnik and the peak of Snežnik. Seeds were also collected on the peak itself, as well as on its southern and eastern slopes. Along the mountain trail through the dwarf pine scrub, seeds were collected among stones and sand and in the understory beneath the dwarf pines. These were shaded and semi-shaded locations. The site on the ridge between Mali Snežnik and Snežnik is a dry grassland with shallow soil, a gentle slope, and western exposure. Plant species whose seeds were collected on and below the peak of Snežnik grew among rocks, on scree, and in patches of dry grassland. The exposure of these sites is southern or southeastern. Soils are shallow and sandy.

2.2.4 Kočevsko

The Kočevsko region covers a relatively large part of the Slovenian Dinarides. It extends across the southern part of Slovenia all the way to the Croatian border. Kočevsko is built of Jurassic and Cretaceous limestones and dolomites. On limestone bedrock, a characteristic karst surface has developed, with karst features such as 'škraplje', dolines, fissures, and others. The soils are brown calcareous soils. This area receives an average annual precipitation of 1,800–2,000 mm,

and the snow cover can persist into spring. In geological history, Kočevsko served as a refuge where some Alpine plant species found shelter from glaciation. The region is characterized by continuous forest cover, with the dominant forest association being *Omphalodo-Fagetum*, as well as by numerous remnants of primeval forests. The influence of Illyrian and Central European floristic elements prevails. While Illyrian–sub-Mediterranean influences are noticeable at lower and warmer sites, a slight influence of the Alpine–Nordic element can be observed at the highest elevations. Grasslands have developed on cleared forest areas, most of which belong to the association *Bromo–Brachypodietum pinnati*. As elsewhere in Kočevsko, these grasslands are rapidly becoming overgrown due to the lack of land management.

In the Kočevsko region, seeds were collected at the site of Kuželj and in its surroundings. The site is located in the valley of the Kolpa River. The Kolpa Valley is a narrow valley running along the border with Croatia. The valley is formed by clay shales and sandstones. Above Kuželj rises a rock wall, whose steep slopes descend into dolines and a karst field. While high precipitation and low temperatures characterize most of Kočevsko, the Kolpa Valley receives less precipitation and experiences smaller temperature extremes. Temperature inversions are common. Due to the sun-exposed slopes, snow melts very quickly. The inflow of warm air masses from the Mediterranean is also characteristic, resulting in the occurrence of sub-Mediterranean and thermophilous plant species. Occasionally, elements of sub-Pannonian flora can also be observed.

2.2.5 Karst Edge

The Karst Edge (Kraški rob) is an area that delineates the boundary between the limestone karst and flysch terrain. It consists of plateaus, steep cliffs, and steep carbonate slopes. In total, as many as 47 rock walls have been recorded in the area. The limestone chain of the Karst Edge begins in Italy at the edge of Redipuglia (Sredipolje), continues into Slovenia, and then into Croatia, forming the first mountainous part of the Dinaric karst landscape. Above Trieste in Italy, this Karst Edge actually reaches the coastline, whereas in Slovenia it is shifted inland and the coastal zone consists only of flysch terrain. This flysch area extends relatively far inland and then ends with several steps of the Karst Edge, which in fact reaches the highest parts of this Dinaric chain. The difference between the Slovenian Karst Edge and its Italian counterpart is that, due to its inland position, true evergreen Mediterranean plant species such as *Phillyrea latifolia*, *Quercus ilex*, and *Laurus nobilis* grow in Slovenia only rarely. These species can still be found at the marginal part of the Karst Edge at Socerb, above Črni Kal, and slightly further on.

The inner part of the Karst Edge is covered only by thermophilous sub-Mediterranean deciduous vegetation without evergreen representatives (*Paliurus spina-christii*, *Colutea arborescens*, *Carpinus orientalis*, *Cercis siliquastrum*). In the lower parts, *Ruscus aculeatus* and *Asparagus acutifolius*, both evergreen species, are widespread and dominant. At higher elevations, these two species are no longer present, while *Asparagus tenuifolius* occurs instead. In the inner part of the Karst Edge, snow appears in winter and, during cold winters, can persist for quite some time, whereas in the lower flysch areas snow is rare. In winter, the boundary between the warm and cold parts of the Karst Edge is relatively clear and visible as a snow line. The marginal part of the Karst Edge, which runs just above the flysch plains and hilly terrain, thus remains warm even in winter.

In the Karst Edge area, seeds were collected at four locations: Rakitovec, Kavčiče, Podpeč, and Črni Kal. Kavčiče and the wider area represent a karst plateau above the small village of Rakitovec. The surface of the plateau is shaped by large sing holes that are becoming overgrown with shrub vegetation. Seeds were collected on dry grasslands, in sing holes, and along paths. Some seeds were collected at forest edges within shrub vegetation near the village of Rakitovec. The collection site in Podpeč is a dry grassland with a small rocky cliff and is already becoming overgrown with shrubs of wild roses and smoke tree (*Cotinus coggygria*). The site at Črni Kal is located along the path to the ruins of defensive tower and in the immediate vicinity of the tower. It consists of a combination of shrub vegetation, tall herb stands, and small patches of dry grassland. Seeds were collected just above the steep overhanging cliff among rocks and scree. Seeds of some species were also collected from the grassland.

2.2.6 Planinsko polje

Planinsko polje is a typical karst plain situated at an elevation of approximately 450 m a.s.l. Its surface area is about 11 km². It is surrounded on all sides by hills and low mountains; to the south these are Stari grad (703 m a.s.l.) and Kali (574 m a.s.l.). To the west, the polje is bounded by Planinska gora (924 m a.s.l.), while on the opposite side it is separated from the Logatec Plain (Logaško polje) by low elevations. On the northern side rise the less indistinct elevations of Lanski vrh. On the southern edge of Planinsko polje lies the karst cave known as Planinska jama. The polje is part of the Ljubljanica River basin. Three rivers—Unica, Malenščica, and Škratovka—flow through the area and, during periods of abundant precipitation, can completely flood the polje. The highest flood levels, which occur approximately every 30 to 50 years, can reach heights of up to 10 m (Gams, 1980). Flooding occurs mainly in autumn and spring and increasingly also in winter, as winters are no longer very cold and snowy. Planinsko

polje represents the classical Karst, as it is described as a book example of a classic karst polje. There are no arable fields on the flat plain, primarily due to annual flooding. Agricultural fields are found along the margins, while the lowest parts of the plain are occupied by meadows, pastures, hedgerows, and forest patches. The meadows are highly biodiverse; however, due to increasingly early mowing, they are undergoing significant changes, and some species that were once abundant precisely because of early mowing are disappearing. Among these are two gladiolus species: the Illyrian gladiolus (*Gladiolus illyricus)* and the marsh gladiolus*G. palustris*) (Bavcon & Ravnjak, 2023).

Planinsko polje also hosts the northwesternmost locality of the meadow squill (*Nectaroscilla litardierei*), an endemic species of Dinaric karst poljes (Petkovšek & Seliškar, 1977). The area contains wet meadows with species such as summer snowflake (*Leucojum aestivum*), angular garlic (*Allium angulosum*), adder's-tongue fern (*Ophioglossum vulgatum*), yellow flag iris (*Iris pseudacorus*), marsh gentian (*Gentiana pneumonanthe*), great burnet (*Sanguisorba major*), shining meadow-rue (*Thalictrum lucidum*), erect clematis (*Clematis recta),* and several other species. Despite early mowing and fertilization of the meadows, floods and precipitation periodically prevent excessively early mowing, as Planinsko polje becomes too waterlogged and inaccessible to heavy machinery. Consequently, many formerly widespread species persist along hedgerows and act as a permanent genetic reservoir in the soil. Even under intensive land use, this soil seed bank helps maintain a relatively high level of biodiversity that would otherwise be lost.

2.2.7 Sabotin

Mt. Sabotin (609 m a.s.l.) is an isolated peak into which the Soča River valley is deeply incised, separating it from the neighbouring peak of Sveta gora, which continues as part of a continuous mountain ridge. Sabotin is composed of Cretaceous rudist limestone. It represents a Dinaric ridge, with its southwestern slope descending toward the flysch terrain of the Goriška Brda Hills, while the northwestern slope drops steeply toward the Soča River. Sabotin is botanically very interesting because it represents a contact zone of thermophilous and xerophilous karst flora, including black hornbeam (*Ostrya carpinifolia*), manna ash (*Fraxinus ornus*), whitebeam (*Sorbus aria*), St Lucie cherry (*Prunus mahaleb*), smoke tree (*Cotinus coggygria*), Montpellier maple (*Acer monspessulanum*), holm oak (*Quercus ilex*), mock privet (*Phillyrea latifolia*), and terebinth (*Pistacia terebinthus*). In its northern part, cold-adapted Alpine species are also present, such as auricula (*Primula auricula*), crusted saxifrage (*Saxifraga crustata*), yellow paederota (*Paederota lutea*), rock valerian (*Valeriana saxatilis*), hairy hawkweed (*Hieracium villosum*), variegated moor grass (*Sesleria albicans*), rock masterwort (*Athamantha turbith*), Pirona's medick (*Medicago pironae*), and Justin's bellflower (*Campanula justiniana*) (Wraber, 1996). Seeds of plant species were collected directly on the peak of Sabotin, among rocks, on scree, and within shrub vegetation.

2.2.8 Senožeče

The Senožeče Valley extends along the Senožeče Stream at the northern foothills of Mount Vremščica. Despite its relatively short distance from the Adriatic Sea, winters here are fairly harsh and the growing season begins later. The stream flowing along the valley floor can partially flood the valley, at least in its lower section. Evidence of the late onset of vegetation includes early spring plant species such as the common snowdrop (*Galanthus nivalis*), which

blooms only in the second half of March (Bavcon & Ravnjak, 2020). At this elevation, it is then joined by the spring crocus (*Crocus vernus* subsp. *albiflorus*) (Bavcon, 2010), a species typically characteristic of higher elevations. In slightly higher areas above the valley, additional species begin to flower, including the striped crocus (*Crocus reticulatus*), mountain pasqueflower (*Pulsatilla montana*), mountain daffodil (*Narcissus poeticus* subsp. *radiiflorus*), and the Istrian hellebore (*Helleborus multifidus* subsp. *istriacus*). During summer, distinctly sub-Mediterranean vegetation develops on the dry grasslands, with species such as gas plant (*Dictamnus albus*), winter savory (*Satureja montana*), *Ferulago galbanifera*, *Onobrychis viciifolia*, *Sanguisorba minor*, *Plantago holosteum*, *Dianthus sanguineus*, *Orchis morio*, *O. purpurea*, *O. ustulata*, *Ophrys holosericea*, and *O. sphegodes*. These are exceptionally biodiverse grasslands that could merit nature conservation status, as they host orchid species listed on the Red List of protected plants. Owing to their rich species diversity, these grasslands already fascinated various botanists in the past, including the renowned I. A. Scopoli. Based on specimens collected in Senožeče, he described species such as *O. viciifolia*, *P. holosteum*, and *S. minor*, which therefore have their *locus classicus* in Senožeče (Praprotnik et al., 2023).

2.2.9 Dragonja

Dragonja is a village located directly on the border with Croatia. Immediately adjacent to the village is its characteristic steep limestone cliff, which is protected as a geomorphological and botanical natural monument. This cliff and the nearby Štefan hill represent two isolated limestone "islands" within the flysch landscape of Istria. It appears as if the Karst Edge, characteristic of the interior of Istria, has risen here from the flysch substrate, forming overhangs that create a distinctive habitat where small stands of true maquis vegetation—evergreen shrub communities—can be observed. These stands are composed of holm oak (*Quercus ilex*), mock privet (*Phillyrea latifolia*), and, in places, bay laurel (*Laurus nobilis*). Scattered solitary trees of olive (*Olea europaea*) are also present, along with prickly juniper (*Juniperus oxycedrus*), *Smilax aspera*, and a dense understory of butcher's broom (*Ruscus aculeatus*), sharp-leaved asparagus (*Asparagus acutifolius*), *Osyris alba*, terebinth (*Pistacia terebinthus*), oriental hornbeam (*Carpinus orientalis*), Montpellier maple (*Acer monspessulanum*), Christ's thorn (*Paliurus spina-christii*), smoke tree (*Cotinus coggygria*), downy oak (*Quercus pubescens*), and St Lucie cherry (*Prunus mahaleb*). Only on these limestone islands do species such as the garden anemone (*Anemone hortensis*), autumn squill (*Prospero elisae*), *Aster linosyris*, winter savory (*Satureja montana*), large-flowered orlaya (*Orlaya grandiflora*), Italian gladiolus (*Gladiolus italicus*), and various orchids occur, including *Orchis papilionacea*, *O. purpurea*, and *Himantoglossum adriaticum*.

2.2.10 Podgorje

The Podgorje area represents a plateau-like landscape below the Slavnik hill and above the Karst Edge, where a distinctive karst environment is present. This area differs from the typical Karst by the absence of large dry valleys, sinkholes, and dolines. The terrain is gently hilly and relatively flat, with few characteristic karst features. Historically, most of the area consisted of pastures and meadows on the less rocky parts, while deeper soils with more earth, especially near settlements, were used for arable fields. Due to extensive forest clearing in the past, vast bare areas formed in Podgorje, which began to be afforested in the 19th century. Although local farmers resisted afforestation because the open land was important for small livestock grazing, the Karst was intensively reforested with black pine under the landowners, who saw greater

profit in timber (Panjek 2015, Perko 2016). Nomadic grazing was also practiced here, but after World War II it was largely prohibited, which caused faster overgorwth Today, nearly 200 years later, the dominant vegetation is forest or landscape overgrown with isolated trees and shrubs, and the process of natural succession is advancing rapidly. Traditional land management began to decline in the 1980s, which led to increasing overgrowth (Bavcon et al. 2020). With the revival of grazing today, grassy areas may once again develop. Despite overgrowth, biodiversity remains relatively rich due to dry conditions, harsh winters, and the bora wind. Many grassland species are able to survive in the light-filled forests, maintaining a stable soil seed bank. However, large populations of individual species are disappearing. Fires, which occasionally occur—particularly along the railway—serve as one of the natural mechanisms regulating habitats in this area. A potential issue after fires is the colonization by invasive species, which may establish more quickly than native species. Nevertheless, after a decade or more, the landscape naturally recovers. Following the black pine (*Pinus nigra*) monocultures planted in the 19th and early 20th centuries, the previous forest vegetation has re-established, including species such as manna ash (*Fraxinus ornus*), European hop-hornbeam (*Ostrya carpinifolia*), downy oak (*Quercus pubescens*), Turkey oak (*Quercus cerris*), field maple (*Acer campestre*), Montpellier maple (*Acer monspessulanum*), St Lucie cherry (*Prunus mahaleb*), smoke tree (*Cotinus coggygria*), guelder rose (*Viburnum opulus*), common privet (*Ligustrum vulgare*), and whitebeam (*Sorbus aria*). On open areas, highly biodiverse grasslands dominate, with species such as pheasant's eye (*Narcissus poeticus* subsp. *radiiflorus*), green-winged orchid (*Orchis morio*), fly orchid (*Ophrys insectifera*), globe daisy (*Globularia elongata*), white cinquefoil (*Potentilla alba*), *Potentilla tommasinii*, grape hyacinth (*Muscari neglectum*), winter savory (*Satureja montana*), white dittany (*Dictamnus albus*), *Jurinea mollis*, *Stipa eriocaulis*, hairy melic (*Melica ciliata*), and Austrian viper's grass (*Scorzonera austriaca*).

2.2.11 Uvala Zavratnica (Croatia)

Since 1981, Uvala Zavratnica has been part of the broader Velebit Nature Park. A portion of the submerged cove has been protected as a landscape park since 1964. The landscape here is very rocky and only partially covered with vegetation, either with maquis or scattered individual plants. The vegetation is typically Mediterranean. Not all species are evergreen, as winter temperatures can be quite low. On Velebit, winters can last up to seven months. This broader area is also one of the centers of endemism, as the wider surroundings of the entire Velebit Park host as many as 40 local endemic species. The most well-known endemic of the Velebit area is the Velebit degenia (*Degenia velebitica* (Deg.) Hay). In 1978, UNESCO included the uvala as part of the Velebit Park in the World Biosphere Reserve. The bay itself is only 900 m long and 50–150 m wide, with a fjord-like shape. Zavratnica hosts a variety of plant forms, from trees to shrubs and herbaceous species, including some endemics. The area is mostly limestone and sparsely vegetated due to centuries of grazing, past deforestation, and subsequently harsh dry conditions. As a result, the vegetation is highly xerophytic and evergreen, with many annuals and geophytes. The flora of Zavratnica includes over 116 plant species, 24 of which are legally protected. Typical Illyrian-Dinaric species are present, with the most characteristic being *Iris illyrica* Tomm. The area is part of the Natura 2000 network. Seeds were collected primarily at the entrance of the cove, before it narrows into a canyon, and along the path leading to the top of the plateau. At these sites, seeds were gathered from species growing among rocks and scree. On the plateau itself, seeds were collected from remnants of dry grasslands.

2.3 Seed Collection, Drying, and Storage

In the field, all seeds were collected in plastic bags with handles, which could be worn on the arms, allowing us to collect seeds from multiple plant species simultaneously. If individual seeds were not yet fully mature, we collected a larger portion of the plant material to allow further maturation of the seeds. Each bag also contained a small label with the name of the plant species, the date, and the collection location. At the Botanical Garden, the seeds were transferred from the plastic bags into paper bags and exposed to drying in a dry room. There, the seeds dried and fully matured. The seeds were then cleaned of any remaining plant material. Part of the seeds was stored in paper bags in the dry seed bank, and part in glass vials in the long-term seed bank (stored in freezers at –20 °C). In the dry seed bank, seeds are kept in wooden cabinets at 21 °C, while in the long-term seed bank, they are stored in freezers at –20 °C. Both the paper bags and the glass vials were appropriately labelled with the plant species name, collection date, and collection location.

2.4 Sowing

Seeds of some of the collected plant species (Table 1) were also sown 15ort hi purpose of supplementing the living plant collection at the Botanical Garden. The cleaned seeds were sown in plastic pots measuring 12 × 12 cm. For sowing, we used a sterile mixture of commercially purchased soil, to which vermiculite was added for extra aeration. Each pot was labeled with a tag indicating the plant species name and the sowing date. The pots were placed in the outdoor section of the Botanical Garden's cultivation area, as some species require winter frost to successfully break dormancy and achieve successful germination.

3 RESULTS

In the Dinaric region, we conducted a total of 11 field days, carried out in June, July, August, September, October, November, and December 2025. Overall, seeds were collected from 26 locations. We collected seeds of 154 different plant species, which in our seed bank correspond to 199 accessions (one accession represents seeds of a single species collected at one location on one collection date) (Appendix 1).

Table 1: Monthly species collection count..

June	July	August	September	October	November	December
3	30	28	5	25	58	31

The largest number of seeds was collected in November, and the fewest in September. The highest number of species was collected at Snežnik (29) and Kucelj (17). Among the collected species, 17 are listed on the Slovenian Red List of protected species (*Dianthus sylvestris* subsp. *tergestinus, Dianthus sanguineus, Gentiana clusii, Gentiana pneumonanthe, Gladiolus illyricus, Gymnadenia conopsea, Leontopodium alpinum, Lilium carniolicum, Primula auricula, Pulsatilla alpina, Ruscus aculeatus, Serratula lycopifolia, Spiranthes spiralis, Stipa eriocaulis, Iris sibirica* subsp. *erirrhiza, Iris graminea, Paeonia officinalis*), , 2 species are Dinaric endemics (*Allium dinaricum, Onosma stellulata*), and 2 species are higly protected Croatian endemics (*Centaurea spinosociliata, Limonium cancellatum*). Of the collected species, 55 have their distribution primarily in the Dinaric region. The remaining species also occur outside the Dinaric region, either in the sub-Mediterranean phytogeographical region, the pre-Dinaric and pre-Alpine regions, or, in a smaller number, in the Alpine phytogeographical region. Among the species primarily distributed in the Dinaric region, it is important to note those, whose seeds have not yet been stored in the seed bank of the Botanic Garden of the University of Ljubljana, or for which very few accessions exist from previous collections. 16ort hi first time, seeds from the following 20 species will be stored in our seed bank from natural habitats: *Alchemilla velebitica, Allium dinaricum, Athamanta cretensis, Camphorosma monspeliaca, Centaurea spinosociliata, Cephalaria leucantha, Clematis flammula, Drypis spinosa, Helianthemum alpestre, Helianthemum rupifragum, Helichrysum italicum, Limonium cancellatum, Micromeria juliana, Onosma stellulata, Plantago altissima, Plantago argentea subsp. liburnica, Reichardia picroides, Scabiosa silenifolia, Spiranthes spiralis,* and *Teucrium flavum*. Some other species (*Edraianthus graminifolius, Erigeron polymorphus, Fumana procumbens, Hyssopus officinalis*) are also very rarely represented in our seed bank, and this collection provides an additional source for long-term seed conservation.

Table 2: List of plant species whose seeds were collected within the project of the Alpine Garden Society fund (seed collectors: Jože Bavcon, Blanka Ravnjak, Katja Malovrh, Maja Tomšič, Katarina Husnjak Malovec)

Plant species	**Author**	**Date**	**Locality**
Achillea clavenae	L.	12.08.2025	Snežnik
Aconitum variegatum	L.	5.11.2025	Čaven
Alchemila velebitica	Borbas	12.08.2025	Snežnik

Alium carinatum	L.	28.10.2025	Kuželj
Allium angulosum	L.	9.10.2025	Planinsko polje
Allium dinaricum	Bogdanović, Anačkov, Ćato, Borovečki-Voska, Salmeri&Brullo	15.10.2025	Uvala Zavratnica - inland
Allium ericetorum	Thore	5.11.2025	Kucelj
Allium ericetorum	Thore	27.11.2025	Kavčiče
Allium scorodoprasum	L.	15.07.2025	before Hrušico
Allium senescens	L.	8.12.2025	Podgorje – meadow
Allium senescens	L.	8.12.2025	Črni kal
Allium senescens	L.	27.11.2025	Rakitovec – Kavčiče
Allium sphaerocephalon	L.	6.09.2025	Sabotin
Allium victorialis	L.	12.08.2025	Snežnik
Androsace villosa	L.	12.08.2025	Snežnik
Angelica sylvestris	L.	5.11.2025	Čaven
Anthericum ramosum	L.	28.10.2025	Kuželj
Anthyllis jacquinii	Kern.	15.07.2025	Plato kapelica – Nanos
Aquilegia nigricans	Baumg.	15.07.2025	Nanosa peak
Arabis sagitatta	(Bertol) DC.	8.12.2025	Podgorje
Arabis turitta	L.	5.11.2025	Kucelj-Čaven
Arabis turrita	L.	15.07.2025	Rajske poljane – Nanos
Artemisia alba	Turra	5.11.2025	Otlica
Artemisia alba	Turra	27.11.2025	Podpeč
Artemisia alba	Turra	8.12.2025	Črni kal
Asparagus acutifolius	L.	8.12.2025	Črni kal
Asparagus acutifolius	L.	27.11.2025	Podpeč
Asparagus tenuifolius	Lam.	28.10.2025	Kuželj
Asphodelus albus	Mill.	15.07.2025	plateau Preval – Nanos
Asphodelus albus	Mill.	15.07.2025	Rajske poljane – Nanos
Asphodelus albus	Mill.	15.07.2025	shepherd's hut – Nanos
Asphodelus albus	Mill.	27.11.2025	Kavčiče
Aster lynosiris	(L.)Rchb.f.	16.11.2025	Dragonja
Astragalus carniolicus	Kern.	15.07.2025	Plato kapelica – Nanos
Astragalus carniolicus	Kern.	5.11.2025	Kucelj
Athamanta cretensis	L.	12.08.2025	Snežnik
Betonica officinalis	L.	8.12.2025	Podgorje – meadow
Betonica officinalis	L.	23.07.2025	Planinsko polje
Buglusoides purpurocaerulea	(L.) J.M. Johnston	16.11.2025	Dragonja
Buphtalmum salicifolium	L.	5.11.2025	Kucelj
Buphtalmum salicifolium	L.	12.08.2025	Snežnik
Calamintha mentifolia	Host.	28.10.2025	Kuželj
Calamintha mentifolia	Host.	8.12.2025	Črni kal

Campanula cespitosa	Scop.	5.11.2025	Kucelj-Čaven
Campanula pyramidalis	L.	8.12.2025	Črni kal
Campanula thyrsoides	L.	28.10.2025	Kuželj
Camphorosma monspeliaca	L.	15.10.2025	Uvala Zavratnica-inland
Carduus crassifolius subsp. Crassifolius	Willd.	5.11.2025	Kucelj
Carex alba	Scop.	28.10 2025	Belica
Carpinus orientalis	Mill.	16.11.2025	Dragonja
Centaurea rupestris	L.	15.07.2025	Plato kapelica – Nanos
Centaurea rupestris	L.	5.11.2025	Čaven
Centaurea scabiosa	L.	15.07.2025	Rajske poljane – Nanos
Centaurea scabiosa	L.	8.12.2025	Podgorje
Centaurea spinosociliata	Seenus	15.10.2025	Uvala Zavratnica-inland
Centaurea triumfetti	All.	5.11.2025	Kucelj
Centaurea triumfettii	All.	15.07.2025	Plato kapelica – Nanos
Centaurea triumfettii	All.	15.07.2025	Rajske poljane – Nanos
Cephalaria leucantha	(L.) Schrad.ex Roem.&Schult	15.10.2025	Uvala Zavratnica – inland
Chamaespartium sagittale	(L.) Gibbs.	15.07.2025	Rajske poljane – Nanos
Cicerbita alpina	(L.) Wallr.	12.08.2025	Snežnik
Cirsium pannonicum	(L.f.) Link	15.07.2025	Rajske poljane – Nanos
Clematus flammula	L.	15.10.2025	Uvala Zavratnica – inland
Coronilla emerus subsp. Emeroides	(L.) Boiss. & Spruner) Holmboe	8.12.2025	Črni kal
Dianthus sanguineus	Vis.	15.07.2025	shepherd's hut – Nanos
Dianthus sanguineus	Vis.	27.11.2025	Kavčiče
Dianthus sylvestris subsp. Tergestinus	(Rchb.) Hayek	15.07.2025	shepherd's hut – Nanos
Dianthus sylvestris subsp. Tergestinus	(Rchb.) Hayek	15.10.2025	Uvala Zavratnica – inland
Dianthus sylvestris subsp. Tergestinus	(Rchb.) Hayek	5.11.2025	Kucelj
Dianthus sylvestris subsp. Tergestinus	(Rchb.) Hayek	6.09.2025	Sabotin
Dictamnus albus	L.	15.07.2025	Senožeče
Dorycnium germanicum	(Gremli) Rouy	15.07.2025	Rajske poljane – Nanos
Drypis spinosa	L.	15.10.2025	Uvala Zavratnica – inland
Echinops ritro subsp. Ruthenicus	L. (Bieb.) Nyman.	5.11.2025	Čaven
Echium vulgare	L.	5.11.2025	Čaven

Edraianthus graminifolius	(L.) A. DC. Ex Meisn.	12.08.2025	Snežnik
Eonymus europaeus	L.	5.11.2025	Otlica
Eonymus europaeus	L.	16.11.2025	Dragonja
Erigeron polymorphus	Scop.	12.08.2025	Snežnik
Eryngium amethystinum	L.	27.11.2025	Rakitovec – Kavčiče
Erysimum sylvestre	Scop.	5.11.2025	Kucelj
Erysimum sylvestre	Scop.	6.09.2025	Sabotin
Ferulago galbanifera	(Mill.) W.D.J.Koch	8.12.2025	Podgorje
Fraxinus ornus	L.	8.12.2025	Podgorje
Fraxinus ornus	L.	27.11.2025	Rakitovec – Kavčiče
Fraxinus ornus	L.	27.11. 2025	Kavčiče
Fumana precumbes	(Dunal) Gren.& Godr.	15.10.2025	Uvala Zavratnica – inland
Galium lucidum	All.	15.10.2025	Uvala Zavratnica – inland
Galium rubrum	L.	8.12.2025	Črni kal
Galium verum	L.	5.11.2025	Čaven
Genista sylvestris	Scop.	15.07.2025	Plato kapelica – Nanos
Gentiana clusii	E.P.Perrier&Songeon	12.08.2025	Snežnik
Gentiana pneumonanthe	L.	23.07.2025	Planinsko polje
Geranium sylvaticum	L.	12.08.2025	Snežnik
Gladiolus illyricus	W.D.J.Koch	23.07.2025	Planinsko polje
Globularia cordifolia	L.	12.08.2025	Snežnik
Globularia elongata	Hegetschw.	8.12.2025	Podgorje
Globularia elongata	Hegetschw.	15.07.2025	shepherd's hut – Nanos
Globularia elongata	Hegetschw.	15.07.2025	Rajske poljane – Nanos
Gymnadenia conopsea	(L.) R.BR.	12.08.2025	Snežnik
Hedera helix	L.	8.12.2025	Podgorje
Helianthemum alpestre	(Jacq.) Dc	12.08.2025	Snežnik
Helianthemum alpestre	(Jacq.) Dc	12.08.2025	Snežnik
Helianthemum rupifragum	Kern.	15.07.2025	vrh Nanosa
Helichrysum italicum	(Roth) G.Don fil. In Loudon	15.10.2025	Uvala Zavratnica – inland
Heliosperma alpestre	Rchb.	12.08.2025	Snežnik
Hypochaeris maculata	L.	15.07.2025	Rajske poljane – Nanos
Hyssopus officinalis	L.	8.12.2025	Črni kal
Hyssopus officinalis	L.	27.11.2025	Podpeč
Inula conyza	DC	8.12.2025	Podgorje
Inula conyza	DC	8.12.2025	Podgorje
Inula ensifolia	DC	5.11.2025	Kucelj
Inula ensifolia	DC	27.11.2025	Kavčiče
Inula hirta	L.	15.07.2025	Plato kapelica – Nanos
Inula hirta	L.	15.07.2025	Rajske poljane – Nanos

Inula hirta	L.	5.11.2025	Kucelj
Inula hirta	L.	27.11.2025	Kavčiče
Inula salicina	L.	8.12.2025	Podgorje
Iris graminea	L.	27.11.2025	Kavčiče
Iris sibirica subsp. erirrhiza	(Pospichal) T. Wraber	27.11.2025	Kavčiče
Juniperus communis	L.	8.12.2025	Podgorje
Jurinea mollis	(L.) Reichenb.	27.11.2025	Rakitovec – Kavčiče
Laserpitium latifolium	L.	5.11.2025	Otlica
Laserpitium peucedanoides	L.	12.08.2025	Snežnik
Leontopodium alpinum	Cass.	12.08.2025	Snežnik
Ligustrum vulgare	L.	8.12.2025	Podgorje
Lillium carniolicum	Bernh. Ex W.D.J. Koch	12.08.2025	Snežnik
Limonium cancellatum	(Bernh. Ex Bertol.) Kuntze	15.10.2025	Uvala Zavratnica-inland
Linum narbonense	L.	15.07.2025	Rajske poljane – Nanos
Lonicera alpigena	L.	12.08.2025	Snežnik
Lunaria rediviva	L.	5.11.2025	Kucelj
Marrubium incanum	Desr.	8.12.2025	Črni kal
Melica ciliata	L.	8.12.2025	Črni kal
Micromeria juliana	(L.) Benth.ex Rchb.	15.10.2025	Uvala Zavratnica – inland
Micromeria thymifolia	(Scop.) Fritsch.	5.11.2025	Otlica
Muscari botryoides	(L.) Mill.	7.06.2025	Rakitovec – Kavčiče
Myrhis odorata	(L.)Scop.	12.08.2025	Snežnik
Onosma stellulata	Waldst. & Kit.	15.10.2025	Uvala Zavratnica – inland
Origanum vulgare	L.	28.10.2025	Kuželj
Paeonia officinalis	L.	27.11.2025	Kavčiče
Paliurus spina-christi	Mill.	16.11.2025	Dragonja
Peucedanum asutricaum	(Jacq.) W.D. J. KochDc	12.08.2025	Snežnik
Phyteuma orbiculare	L.	12.08.2025	Snežnik
Phyteuma ovatum	Honck.	12.08.2025	Snežnik
Phyteuma spicatum	L.	15.07.2025	vrh Nanosa
Pistacia trebinthus	L.	16.11.2025	Dragonja
Planatago holosteum	Scop.	15.07.2025	Rajske poljane – Nanos
Plantago altissima	L.	23.07.2025	Planinsko polje
Plantago argentea subsp. liburnica	Ravnik	15.07.2025	shepherd's hut – Nanos
Plantago argentea subsp. liburnica	Ravnik	8.12.2025	Podgorje – travnik
Plantago holosteum	Scop.	15.07.2025	shepherd's hut – Nanos
Potentilla caulescens	Torn.	5.11.2025	Kucelj
Primula auricula	L.	5.11.2025	Kucelj
Prospero elisae	Speta	16.11.2025	Dragonja
Prunus mahaleb	L.	25.06.2025	Sočerga
Pulsatilla alpina	(L.) Chaz.	12.08.2025	Snežnik

Reichardia picroides	(L.) Roth.	15.10.2025	Uvala Zavratnica-inland
Ribes alpinum	L.	12.08.2025	Snežnik
Rosa gallica	L.	8.12.2025	Podgorje
Rosa pendulina x R. spinosissima	L. L.	5.11.2025	Čaven
Rosa sempervirens	L.	16.11.2025	Dragonja
Rubia tinctorum	L.	16.11.2025	Dragonja
Rubus saxatilis	L.	12.08.2025	Snežnik
Ruscus aculeatus	L.	16.11.2025	Dragonja
Ruta divaricata	Ten.	5.11.2025	Otlica
Satureja subspicata subsp. Liburnica	Bartl.ex Vis. Šiliae	8.12.2025	Podgorje – travnik
Satureja subspicata subsp. liburnica	Bartl.ex Vis. Šiliae	5.11.2025	Kucelj
Satureja montana subsp. variegata	L. (Host) P. W. Ball	8.12.2025	Črni kal
Satureja montana subsp. variegata	L.(Host) P.W.Ball	27.11.2025	Rakitovec – Kavčiče
Satureja subspicata subsp. Liburnica	Bartl.ex Vis. Šiliae	27.11.2025	Rakitovec – Kavčiče
Satureja subspicata subsp. Liburnica	Bartl.ex Vis. Šiliae	27.11.2025	Kavčiče
Scabiosa graminifolia	L.	5.11.2025	Čaven
Scabiosa silenifolia	Waldst. & Kit.	12.08.2025	Snežnik
Scabiosa triandra	L.	8.12.2025	Podgorje – travnik
Scrophularia juratensis	(W.D.J.Koch)P. Fourn	8.12.2025	Podgorje – travnik
Sempervivum tectorum	L.	5.11.2025	Kucelj
Serratula lycopifolia	(Vill.) Kern.	27.11.2025	Rakitovec – Kavčiče
Serratula lycopifolia	(Vill.) Kern.	27.11.2025	Kavčiče
Serratula tinctoria	L.	27.11.2025	Rakitovec – Kavčiče
Seseli libanotis	(L.) Koch	5.11.2025	Čaven
Sesleria autumnalis	(scop.) Fritsch.	8.12.2025	Podgorje – travnik
Silene hayekiana	Handel-Mazzeti & Janchen	15.07.2025	vrh Nanosa
Silene hayekiana	Handel-Mazzeti & Janchen	6.09.2025	Sabotin
Spiranthes spiralis	(L.) Chevall.	8.12.2025	Podgorje – travnik
Stachys recta	L.	5.11.2025	Kucelj
Stachys recta	L.	6.09.2025	Sabotin
Stipa eriocaulis	Borbas	7.06.2025	Rakitovec – Kavčiče
Teucrium chamaedrys	L.	28.10.2025	Kuželj
Teucrium flavum	L.	15.10.2025	Uvala Zavratnica – inland
Teucrium montanum	L.	5.11.2025	Kucelj
Teucrium montanum	L.	8.12.2025	Podgorje – travnik
Thalictrum minus	L.	5.11.2025	Kucelj
Trollius europaeus	L.	12.08.2025	Snežnik
Verbascum austriacum	Schott ex Roem. Schult.	28.10.2025	Kuželj
Veronica barrelieri	H. Schott ex Roem.& Schult.	5.11.2025	Kucelj

Veronica barrelieri	H. Schott ex Roem.& Schult.	5.11.2025	Otlica
Veronica barrelieri	H. Schott ex Roem.& Schult.	8.12.2025	Podgorje – travnik
Veronica barrelieri	H. Schott ex Roem.& Schult.	8.12.2025	Podgorje
Veronica barrelieri	H. Schott ex Roem.& Schult.	27.11.2025	Kavčiče

4 DISCUSSION

The targeted collection of plant species seeds in the Dinaric region in 2025 proved to be successful. The number of species which seeds were collected within the framework of the project represents a considerable proportion of all species collected in the wild. Particularly important is the fact that, for some species, seeds were collected from natural populations 22ort hi seed bank 22ort hi very first time. Among the collected species, 17 are legally protected, meaning that storing their seeds in the seed bank provides additional conservation security and the potential for use in plant reintroduction projects. This is particularly important for species declining due to habitat disturbance, mainly grassland species such as *Gladiolus illyricus*, *Serratula lycopifolia*, and various orchids, whose populations are shrinking due to the abandonment of traditional land use, leading to grassland overgrowth. In Slovenia, *P. officinalis* co-occurs with the very rare *P. mascula*, whose presence could not recently be confirmed at historical sites due to forest encroachment on grasslands. Similarly, populations of *P. officinalis*, which thrive in dry grasslands, are declining. Its optimal habitats include spaces around large rocks and smaller groups on the edges of sinkholes, where it is protected from the bora wind yet still receives adequate sunlight. As sinkoholes become overgrown, these populations also decrease. Because seeds of these species germinate only after two to three years, regeneration from seed is very slow, making every seed collected and stored in the seed bank crucial for potential restoration of disappearing populations. Seeds of *Gladiolus illyricus* germinate quickly and successfully; however, seedlings are poorly competitive in overgrown grasslands. In grasslands at the first stage of overgrowth, characterized by large umbellifers such as *Laserpitium siler*, *L. latifolium*, and *Ligusticum seguieri*, *G. illyricus* gradually disappears. Similar pressures caused major declines in *G. palustris* and near-extinction of *G. italicus* (Bavcon & Ravnjak 2023). And *G. imbricatus* has not been recently confirmed in Slovenia.

The collection of seeds from the Slovenian endemic *Iris sibirica* subsp. *erirrhiza*, in slovenian language named after Kojnik Hill, in Slovenian Istria and with its *locus classicus* there (Pospichal 1897), is also significant. For species with a narrow distribution, annual supplementation of the seed bank with new genetic material is essential. As already mentioned before, a particularly valuable contribution comes from seeds of species never before collected and stored in our seed bank. Seven of these species (*A. dinaricum, C. monspeliaca, C. spinosociliata, H. italicum, L. cancellatum, M. juliana, O. stellulata*) are part of Croatian flora and do not occur in Slovenia. This project allowed us to extend fieldwork beyond Slovenia's borders and contribute to the ex-situ conservation of plant species from a neighboring country. Seeds of these species will also be grown to supplement the living plant collection in the Botanic Garden's rock garden, which already partially represents Balkan flora. The collection will include two Dinaric endemics, *A. dinaricum* (a late-flowering onion species, flowering from July to mid-October, found in shaded rocky crevices in forests and on sunny slopes at higher elevations) and *O. stellulata* (a species of heliophytic and chasmophytic vegetation). Among the species collected 23ort hi seed bank 23ort hi first time were *S. silenifolia* and *Plantago argentea* subsp. *liburnica*, both occurring in the Dinaric part of Slovenia. *S. silenifolia* is a hemicryptophyte characteristic of scree slopes and rock crevices, which we found along the hiking trail on Snežnik. Snežnik was thus the site where seeds of some species were collected fort he first time 23ort hi seed bank. On Nanos and in Podgorje, seeds of *P. argentea subsp. liburnica*, characteristic of dry grasslands and described by Slovenian botanist Dr. Vlado Ravnik, were collected 23ort hi first time. Also collected 23ort hi first time were *H. alpestre* and *H. rupifragum*, both growing on rocky slopes, crevices, and scree, with *H. rupifragum* present only on Nanos, confirming its occurrence there after 50 years. Collecting orchid seeds is particularly challenging, as capsules are either very similar among species or must be harvested within a narrow timeframe because the seeds are released rapidly upon maturity. For *S. spiralis*, individuals are very short and difficult to see when they are in fruiting phase. This

species is the latest-flowering orchid in Slovenia and serves as a good indicator of grassland health. Where it occurs, other orchid species are also likely to thrive.

The overall seed collection season was successful, though species flowering in May and early June produced fewer seeds due to poor weather with frequent rainfall. Early May was also unusually cold, reducing pollinator activity and fruit set, as observed in *Rosa* species, which despite being widespread in Slovenia, produced very few hips this year. Seeds could still be collected in December due to an unusually warm autumn. Another factor limiting seed development was the transition from a relatively cool early summer to a hot, dry period, which caused vegetation to desiccate and seed formation to fail. In extreme years, such climatic conditions strongly affect seed yields, as observed in previous years (Bavcon 2012).

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Index seminum anno 2025 collectorum

Jože Bavcon, Janja Makše, Maja Tomšič, Blanka Ravnjak

Abstract

The 2025 Index seminum includes the seeds of 310 species collected in the University Botanic Gardens Ljubljana. All are arranged per families and these are listed in alphabetic order. The alphabetic principles is followed also in listing species within families. The index of the seeds harvested in nature contain 165 units. The total number of units from the year 's Index amounts 505.

Key words: Index seminum, anno 2025 collectorum

Material and methods

Seeds begin to be harvested from the garden plants at the end of April or beginning of May, depending on weather conditions. From then on single species in various parts of the Garden are regularly monitored and their seeds collected in due course. Each species is assigned a suitable label stating the date of harvesting and the name. The seeds of the same species are harvested several times as they mature, more than one 28ort h seeds of the same species is collected. We try to observe the rule to have minimally five plants of the same species in the Garden. The seeds are then left to dry in a dry room. They are dried with regard to their specific nature. Juicy fruit seeds are spread apart and arranged over newspaper sheets. The seeds requiring constant moisture are stored in fine sand immediately after harvesting.

The harvesting of seeds in nature likewise starts in spring and lasts till autumn and even winter. Seeds are collected in different parts of Slovenia. We always take care to remove them from a larger number of specimens, from five specimens of a species in the same habitat. Seeds from a particular habitat are stored in one bag. The habitat and the species, if already known, are put down; if the species is not identified, the whole plant is removed and the species subsequently determined in the Botanic Garden. The non- determined species are photographed on their growing site: plant as a whole and single details, flower, leaves. The bags used to store seeds are made of paper.

Immediately after being brought to the Garden all seeds collected in nature are examined, the non-determined species are determined according to the keys as known from literature or by comparing them with the collection of seed samples. Otherwise the bags are merely left open and put in a dry and naturally aired place. During winter the seeds are cleansed, determinations are reexamined, this time also by using the seed determination keys, and finally by comparing them with the reference collection.

Harvesting seeds in nature is an exacting task. One has to be familiar with the time single plants form mature seeds because some fall off very quickly, so it is difficult to get them at exactly the right moment. A particularly powerful factor in Slovenian Istria, Goriško and Vipavsko is the strong wind typical of those parts of Slovenia. It is essential to be familiar with the habitats of single plant species because numerous plants are well recognizable and visible during their

blossoming period whereas they are later overgrown with other plants and are much harder to find and in consequence also more difficult to determine. It istherefore best to visit single habitats several times a year, which makes the harvesting easier and more reliable.

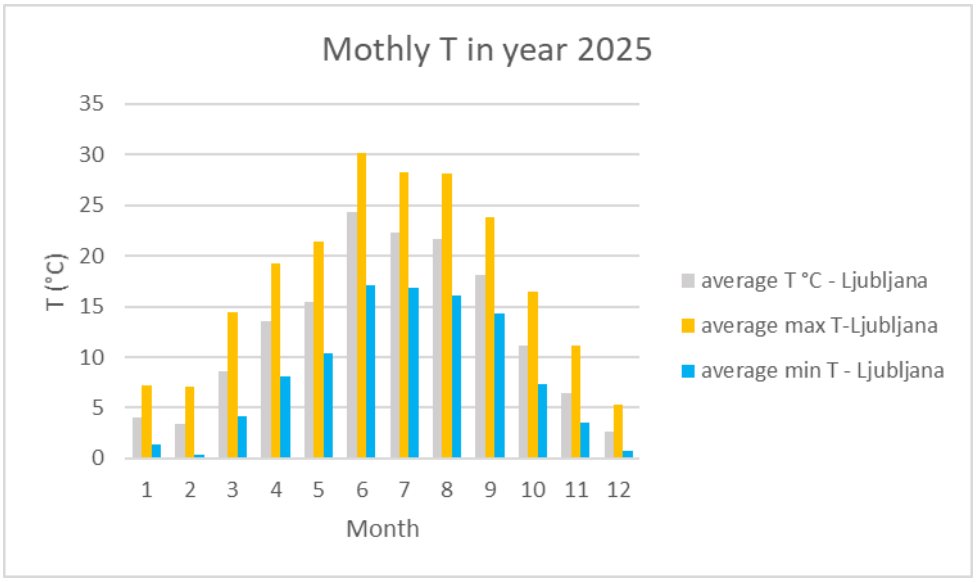

Fig 1: Average, average maximum and average minimum monthly temperature in 2025 in Ljubljana ().

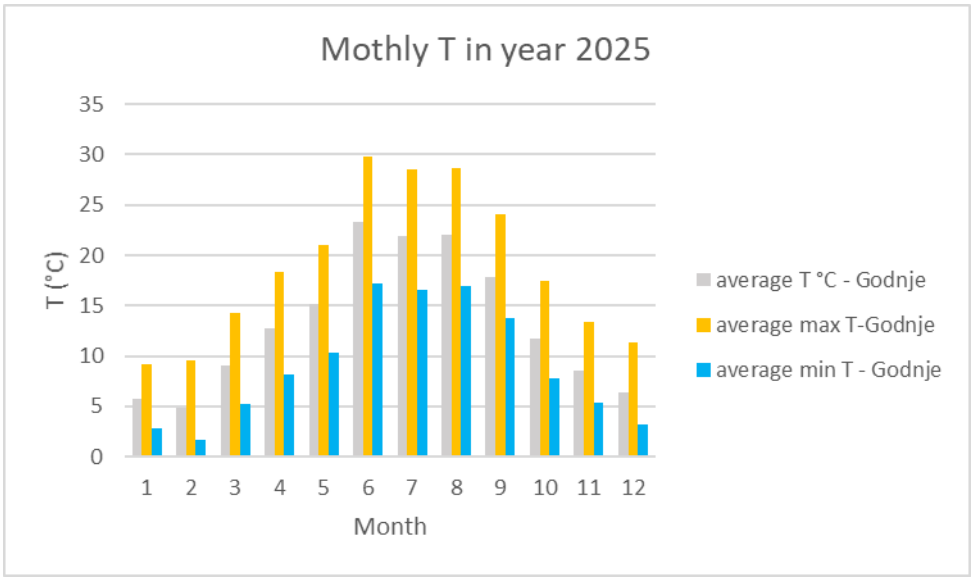

Fig 2: Average, average maximum and average minimum monthly temperature in 2025 in Godnje – subemditerranean part of Slovenia ().

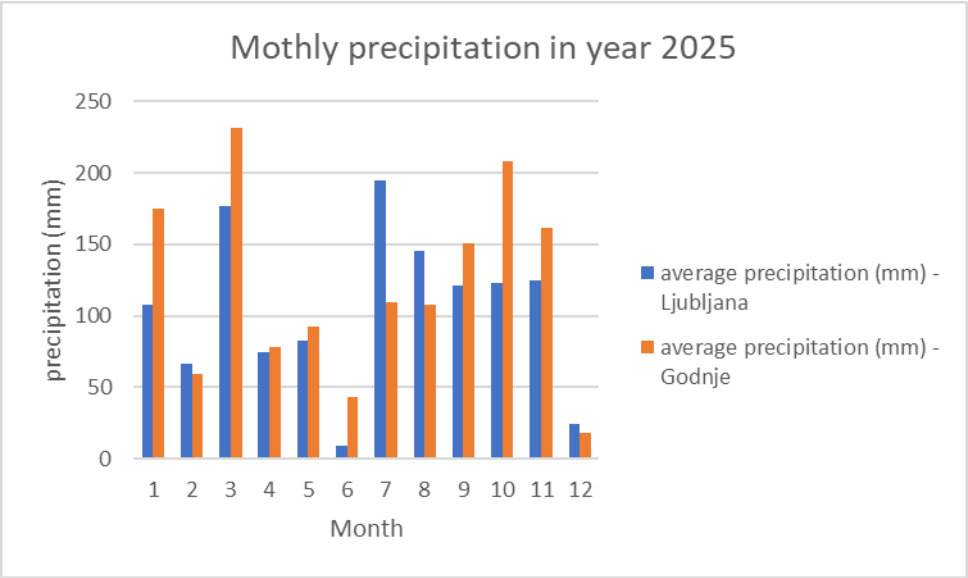

Fig 3: Average monthly precipitation in 2025 in Ljubljana () and Godnje – subemditerranean part of Slovenia ().

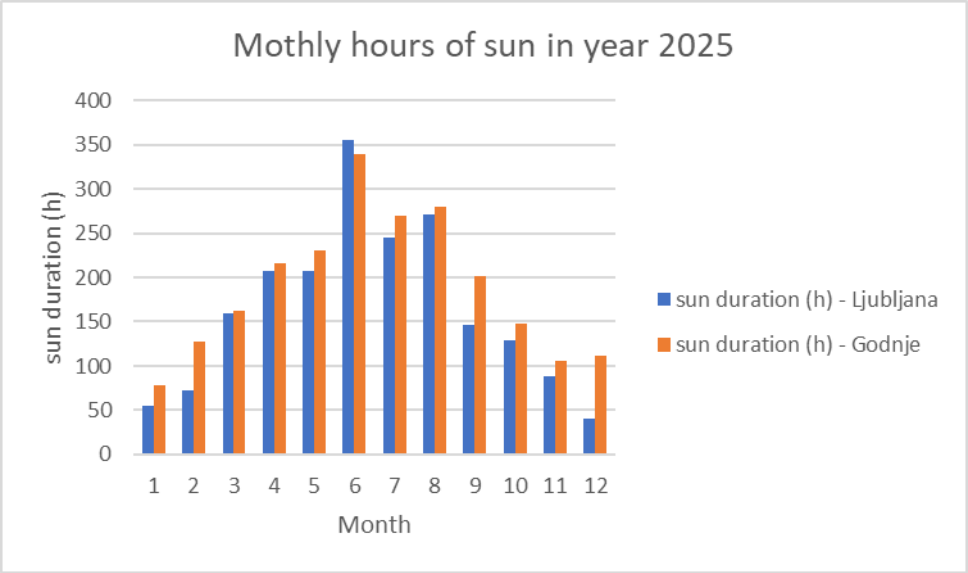

Fig 4: Monthly hours of sun in year 2025 in Ljubljana () and Godnje – subemditerranean part of Slovenia ().

Discussion

Last spring was not the most favorable for seed development. The weather was very cold and unstable for a very long time, so that many early flowering species did not even pollinate properly until almost June. Due to the abundance of rain and cold weather, there were fewer pollinators and seed development was also worse later on. This, which lasted until almost the end of June, with temperatures lower than 30ort his time of year, was followed by a heatwave with a lot of drought. The plants were not adapted to this sudden transition. This is precisely why many species suffered from the collapse of the seed and fruit that had begun to develop. Seed development stalled and, due to prolonged unfavorable conditions, development did not continue. In some, only stunted seeds developed or not at all. Examples include peonies

Paeonia officinalis, *Iris palida* subsp. *illyrica*, and rose hips *Rosa* developed very few fruits. Some of our endemics, especially the genus *Hladnikia pastinacifolia*, practically did not develop seeds because the plant blooms at the beginning of summer, and then a very severe drought with high temperatures set in. Similar conditions were experienced with this endemic in 2003, 2006, 2012 (Bavcon & Makše 2013, Bavcon 2013). Despite everything, a significantly larger number of species were collected in nature, but for many species there are not enough seeds for exchange, so most of them will only be stored in the seed bank.

Index seminum anno 2025 collectorum

Jože Bavcon, Janja Makše, Maja Tomšič, Blanka Ravnjak

CONIFEROPHYTINA
(Gymnospermae)

Cupressaceae

1. *Juniperus virginiana* L. XX-0-LJU-G-555-1253

Pinaceae

2. *Pinus mugo* Turra SI-0-LJU-G-555-546
3. *Tsuga canadensis* (L.) Carrière XX-0-LJU-G-555-744

Taxaceae

4. *Taxus baccata* L. SI-1-LJU-G-555-610

MAGNOLIOPHYTINA
(Angiospermae)

Acanthaceae

5. *Acanthus hungaricus* (Borbás) Baen. XX-0-LJU-G-555-289

Actinidiaceae

6. *Actinidia melanandra* Franch. XX-0-LJU-G-555-636

Alismataceae

7. *Alisma plantago-aquatica* L. SI-0-LJU-G-555-303

Amaranthaceae

8. *Froelichia gracilis* (Hook.) Moq. XX-0-LJU-G-555-424

Amaryllidaceae

9. *Allium ericetorum* Thore XX-0-LJU-G-555-638
10. *Allium sphaerocephalon* L. SI-0-LJU-G-555-307
11. *Allium tuberosum* Rottler ex Spreng. XX-0-LJU-G-999-308
12. *Allium ursinum* L. SI-0-LJU-G-555-309
13. *Galanthus nivalis* L. SI-1-LJU-G-555-426
14. *Leucojum vernum* L. SI-1-LJU-6-997-751

Anacaridaceae

15. *Cotinus coggygria* Scop. XX-0-LJU-G-555-2269
16. *Schinus polygama* (Cav.) Cabrera XX-GZU-YY-110232

Apiaceae

17. *Dichoropetalum schottii* (Besser ex DC.) Pimenov & Kljuykov SI-0-LJU-G-555-544
18. *Eryngium amethystinum* L. SI-0-LJU-G-000-413
19. *Eryngium campestre* L. XX-1-LJU-G-555-414
20. *Orlaya grandiflora* (L.) Hoffm. SI-1-LJU-6-997-760
21. *Peucedanum cervaria* (L.) Lapeyr. SI-0-LJU-N-017-193
22. *Siler montanum* Crantz SI-0-LJU-G-555-984
23. *Smyrnium perfoliatum* L. SI-0-LJU-G-555-599
24. *Torilis japonica* DC. XX-O-LJU-G-999-551

Apocynaceae

25. *Alyxia buxifolia* R.Br. XX-0-WU-0017627
26. *Amsonia tabernaemontana* Walter XX-0-LJU-G-555-317
27. *Vincetoxicum hirundinaria* Medik. SI-0-LJU-G-555-627

Aquifoliaceae

28. *Ilex aquifolium* L. SI-1-LJU-G-555-677

Araceae

29. *Arum maculatum* L. SI-0-LJU-G-555-954

Araliaceae

30. *Eleutherococcus sieboldianus* (Makino) Koidz. XX-0-LJU-G-555-259

Arecaceae

31. *Caryota urens* L. XX-0-LJU-G-555-655
32. *Chamaerops humilis* L. XX-0-LJU-G-999-563
33. *Livinstonia australis* (R.Br.) Mart. XX-O-LJU-G-999-545

Aristolochiaceae

34. *Aristolochia clematitis* L. XX-0-LJU-G-555-324

Asparagaceae

35. *Asparagus densiflorus* (Kunth) Jessop XX-0-LJU-G-555-643
36. *Asparagus tenuifolius* Lam. SI-0-LJU-G-555-955
37. *Bellevalia romana* Rchb. SI-1-LJU-G-555-335
38. *Bowiea volubilis* Harv. XX-0-LJU-G-555-341
39. *Convallaria majalis* L. SI-1-LJU-G-555-377
40. *Danae racemosa* (L.) Moench XX-0-LJU-G-555-389
41. *Hosta ventricosa* Stearn XX-0-LJU-G-555-981
42. *Leopoldia comosa* (L.) Parl. SI-1-LJU-G-555-519
43. *Maianthemum bifolium* (L.) F.W.Schmidt SI-0-LJU-G-000-2279
44. *Muscari neglectum* Guss. Ex Ten. XX-1-LJU-G-555-520
45. *Ornithogalum sphaerocarpum* A. Kern. SI-0-LJU-G-555-533
46. *Ruscus aculeatus* L. SI-1-LJU-G-555-573

Asphodelaceae

47. *Aloe microstigma* Salm-Dyck XX-0-LJU-G-999-558
48. *Asphodeline lutea* Rchb. SI-0-LJU-G-997-261
49. *Asphodeline liburnica* Rchb. SI-1-LJU-6-997-764

Asteraceae

50. *Arctium lappa* L. SI-0-LJU-G-555-952
51. *Artemisia annua* L. XX-0-LJU-G-555-2033
52. *Aster amellus* L. SI-0-LJU-G-002-329
53. *Bellis perennis* L. SI-1-LJU-6-997-765
54. *Buphthalmum salicifolium* L. SI-1-LJU-6-997-767
55. *Calendula officinalis* L. XX-0-LJU-G-555-344

56. *Carduus nutans* L. SI-0-LJU-G-001-354
57. *Carlina vulgaris L.* subsp.*brevibracteata* (Andrae) K.Werner SI-0-LJU-G-555-652
58. *Centaurea stoebe* L. XX-0-LJU-G-999-562
59. *Chamomilla recutita* (L.) Rauschert XX-0-LJU-G-555-365
60. *Coreopsis grandiflora* Hogg ex Sweet XX-0-LJU-G-555-378
61. *Cosmos sulphureus* Cav. XX-0-LJU-G-555-383
62. *Cota tinctoria* (L.) J.Gay RS-0-LJU-G-555-322
63. *Echinacea purpurea* (L.) Moench XX-0-LJU-G-555-407
64. *Echinops exaltatus* Schrad. XX-0-LJU-G-555-2272
65. *Echinops sphaerocephalus* L. XX-0-LJU-G-555-1625
66. *Eupatorium cannabinum* L. SI-0-LJU-G-555-418
67. *Euthamia graminifolia* (L.) Nutt. XX-0-LJU-G-555-601
68. *Gaillardia aristata* Pursh US-0-GZU-18420639
69. *Gelasia villosa* (Scop.) Cass. XX-0-LJU-G-999-565
70. *Grindelia squarrosa* (Pursh) Dunal XX-0-LJU-G-999-567
71. *Hieracium tomentosum* L. XX-0-LJU-G-555-459
72. *Inula conyza* DC. SI-0-LJU-G-015-1628
73. *Inula ensifolia* L. SI-0-LJU-G-555-470
74. *Inula helenium* L. XX-0-LJU-G-555-471
75. *Inula magnifica* Lipsky XX-0-LJU-G-555-473
76. *Klasea lycopifolia (*Vill.) Á.Löve & D.Löve SI-1-LJU-G-555-589
77. *Lapsana communis* L. XX-0-LJU-G-555-486
78. *Leontodon hispidus* L. subsp. *brumatii* (Rchb.) Wraber SI-0-LJU-G-555-488
79. *Leontodon hispidus* L. subsp. *danubialis* (L.) Corb. SI-0-LJU-G-010-489
80. *Leucanthemum ircutianum* DC. SI-0-LJU-G-001-684
81. *Liatris elegans* (Walter) Michx. XX-0-BGAT-0006449
82. *Liatris pilosa* (Aiton) Willd. XX-0-LJU-G-555-490
83. *Liatris pycnostachya* Michx. XX-0-LJU-G-555-491
84. *Pilosella aurantiaca* (L.) F.W.Schultz & Sch.Bip. XX-0-LJU-G-555-457
85. *Pilosella officinarum* F.W.Schultz & Sch.Bip. SI-0-LJU-G-001-460
86. *Pulicaria dysenterica* Gaertn. XX-0-LJU-G-555-558
87. *Silphium integrifolium* Michx. XX-0-LJU-G-555-594
88. *Silybum marianum* (L.) Gaertn. XX-0-LJU-G-555-596
89. *Tagetes erecta* L. XX-0-LJU-G-555-286
90. *Tagetes tenuifolia* Cav. XX-0-LJU-G-555-608
91. *Tragopogon balcanicus* Velen. RS-0-LJU-G-998-615
92. *Tragopogon orientalis* L. SI-0-LJU-G-555-1019
93. *Tragopogon pterodes* Pančić ex Petrovič RS-0-LJU-G-998-616
94. *Tripleurospermum inodorum* (L.) Sch.Bip. XX-0-LJU-G-999-590
95. *Verbesina helianthoides* Michx. XX-0-LJU-G-555-2058
96. *Zinnia elegans* Jacq. XX-0-LJU-G-555-631

Betulaceae

97. *Alnus glutinosa* (L.) Gaertn. XX-0-LJU-G-555-640

98. *Carpinus betulus* L. SI-0-LJU-G-555-2036
99. *Carpinus orientalis* Mill. XX-0-LJU-G-555-653

Boraginaceae

100. *Anchusa officinalis* L. XX-0-LJU-G-555-260
101. *Cerinthe minor* L. SI-0-LJU-G-019-1622
102. *Nonea lutea* (Desr.) DC. XX-0-LJU-G-555-989
103. *Pulmonaria officinalis* L. SI-1-LJU-6-997-761

Brassicaceae

104. *Alyssoides utriculata* (L.) Medik. ME-0-LJU-G-001-314
105. *Alyssum wulfenianum* Willd. Subsp. *ovirense* (A.Kern.) Magauer, Schönsw. & Frajman XX-0-LJU-G-555-2263
106. *Aurinia sinuata* (L.) Griseb. XX-0-LJU-G-555-313
107. *Barbarea vulgaris* W.T.Aiton XX-0-LJU-G-555-957
108. *Fibigia clypeata* (L.) Medik. HR-0-LJU-G-555-420
109. *Isatis tinctoria* L. XX-0-LJU-G-555-481
110. *Lunaria rediviva* L. SI-0-LJU-G-555-500
111. *Sisymbrium austriacum* Jacq. XX-0-LJU-G-555-1269

Buxaceae

112. *Sarcococca saligna* (D.Don) Müll.Arg. XX-0-LJU-G-555-579

Calycanthaceae

113. *Sinocalycanthus chinensis* (W.C.Cheng & S.Y.Chang) W.C.Cheng & S.Y.Chang ex P.T.Li XX-0-LJU-G-555-597

Campanulaceae

114. *Campanula justiniana* Witasek SI-0-LJU-G-555-347
115. *Campanula persicifolia* L. SI-0-LJU-G-555-349
116. *Campanula poscharskyana* Degen HR-0-LJU-G-555-350
117. *Lobelia siphilitica* L. XX-0-LJU-G-555-498

Caprifoliaceae

118. *Cephalaria gigantea* (Ledeb.) Bobrov XX-0-LJU-G-555-361
119. *Lomelosia graminifolia* (L.) Greuter & Burdet SI-0-LJU-G-555-582
120. *Scabiosa lucida* Vill. SI-0-LJU-G-555-583
121. *Succisa pratensis* Moench SI-1-LJU-6-997-763
122. *Succisella inflexa* (Kluk) Beck SI-1-LJU-G-020-1647

123. *Valeriana officinalis* L. XX-0-LJU-G-555-745
124. *Scabiosa atropurpurea* L. XX-O-KL-2012-1376

Caryophyllaceae

125. *Dianthus armeria* L. SI-1-LJU-G-000-395
126. *Dianthus barbatus* L. SI-1-LJU-6-997-756
127. *Dianthus ferrugineus* Mill. IT-0-LJU-G-555-2042
128. *Dianthus monspessulanus* L. SI-1-LJU-6-997-757
129. *Dianthus sternbergii* Sieber ex Capelli SI-1-LJU-6-997-758
130. *Dianthus sylvestris* Wulfen subsp. *tergestinus* (Rchb.) Hayek SI-1-LJU-G-555-400
131. *Petrorhagia prolifera* (L.) P.W.Ball & Heywood XX-0-LJU-G-555-713
132. *Petrorhagia saxifraga* Link SI-0-LJU-G-555-543
133. *Silene coronaria* (L.) Clairv. XX-0-LJU-G-555-691

Celastraceae

134. *Celastrus orbiculatus* Thunb. XX-0-LJU-G-555-265
135. *Euonymus europaeus* L. SI-0-LJU-G-555-417

Cistaceae

136. *Helianthemum nummularium* (L.) Mill. XX-0-LJU-G-555-451

Cornaceae

137. *Cornus mas* L. SI-0-LJU-G-555-380

Costaceae

138. *Costus dubius* (Afzel.) K.Schum. RO-0-LJU-G-009-1623

Crassulaceae

139. *Petrosedum rupestre* (L.) P.V.Heath XX-0-LJU-G-999-577
140. *Sedum sexangulare* L. SI-1-LJU-6-997-565

Cucurbitaceae

141. *Bryonia cretica* L. subsp. *dioica* (Jacq.) Tutin XX-0-LJU-G-555-2266

Datiscaceae

142. *Datisca cannabina* L. XX-0-LJU-G-555-390

Dioscoreaceae

143. *Dioscorea balcanica* Košanin SI-0-LJU-G-555-402

Elaeagnaceae

144. *Elaeagnus multiflora* Thunb. XX-0-LJU-G-555-667

Euphorbiaceae

145. *Ricinus communis* L. XX-0-LJU-G-555-724

Fabaceae

146. *Acacia cyclops* A.Cunn. ex G.Don XX-0-LJU-G-999-556
147. *Cercis siliquastrum* L. XX-1-LJU-G-555-363
148. *Desmodium canadense* (L.) DC. XX-0-LJU-G-555-271
149. *Laburnum anagyroides* Medik. SI-0-LJU-G-555-484
150. *Lathyrus sylvestris* L. XX-0-LJU-G-999-570
151. *Leucaena leucocephala* (Lam.) de Wit XX-GZU-YY-110257
152. *Melilotus albus* Medik. XX-0-LJU-G-999-573
153. *Schotia latifolia* Jacq. XX-0-LJU-G-999-583
154. *Spartium junceum* L. XX-0-LJU-G-555-2294
155. *Trifolium pratense* L. XX-0-LJU-G-999-589

Gentianaceae

156. *Centaurium erythraea* Rafn SI-1-LJU-6-997-755
157. *Gentiana cruciata* L. SI-1-LJU-6-998-754

Geraniaceae

158. *Erodium cicutarium* (L.) L'Hér. SI-0-LJU-G-555-971
159. *Geranium macrorrhizum* L. SI-0-LJU-G-555-433
160. *Geranium pratense* L. XX-0-LJU-G-555-2274

Hamamelidaceae

161. *Hamamelis japonica* Siebold & Zucc. XX-0-LJU-G-555-274
162. *Hamamelis virginiana* L. XX-0-LJU-G-555-275

Hydrangeaceae

163. *Hydrangea paniculata* Siebold XX-0-LJU-G-999-569

Hydrophylllaceae

164. *Nemophila maculata* Benth. Ex Lindl. XX-0-LJU-G-555-523

Hypericaceae

165. *Hypericum kalmianum* L. XX-0-LJU-G-555-463
166. *Hypericum olympicum* L. XX-0-LJU-G-555-464
167. *Hypericum perforatum* L. SI-0-LJU-G-555-676
168. *Hypericum tetrapterum* Fr. SI-0-LJU-G-555-466

Iridaceae

169. *Crocus pulchellus* Herb. XX-0-LJU-G-555-1624
170. *Crocus speciosus* M.Bieb. XX-0-LJU-G-555-386
171. *Crocus tommasinianus* Herb. XX-O-LJU-G-999-541
172. *Crocus vernus* (L.) Hill SI-0-LJU-G-555-387
173. *Gladiolus illyricus* W.D.J.Koch SI-1-LJU-G-555-1246
174. *Iri graminea* L. SI-1-LJU-G-555-476
175. *Iris pallida* Lam. SI-0-LJU-G-555-477
176. *Iris pallida* Lam. Subsp. *illyrica* (Tomm. Ex Vis.) K.Richt. SI-1-LJU-6-997-767
177. *Iris sibirica* L. subsp. *erirrhiza* (Posp.) Asch. & Graebn. SI-1-LJU-G-555-479
178. *Sisyrinchium bermudiana* L. SI-0-LJU-G-555-598
179. *Sisyrinchium striatum* Sm. XX-0-LJU-G-999-584

Juglandaceae

180. *Carya cordiformis* (Wangenh.) K.Koch XX-0-LJU-G-555-654
181. *Juglans cinerea* L. XX-0-LJU-G-555-679
182. *Juglans nigra* L. XX-0-LJU-G-555-680
183. *Pterocarya fraxinifolia* (Poir.) Spach XX-0-LJU-G-555-557

Lamiacae

184. *Betonica officinalis* L. SI-0-LJU-G-555-336
185. *Betonica officinalis* L. subsp. *serotina* (Host) Nyman SI-0-LJU-G-555-337
186. *Horminum pyrenaicum* L. XX-1-LJU-G-555-675
187. *Lavandula angustifolia* Mill. SI-0-LJU-G-555-487
188. *Melissa officinalis* L. SI-0-LJU-G-555-278
189. *Mentha pulegium* L. SI-0-LJU-G-555-510
190. *Phlomis tuberosa* (L.) Moench XX-0-LJU-G-555-545

191. *Pseudodictamnus hispanicus* (L.) Salmaki & Siadati XX-1-LJU-G-555-334
192. *Salvia glutinosa* L. SI-0-LJU-G-555-575
193. *Salvia verticillata* L. SI-0-LJU-G-555-577
194. *Scutellaria altissima* L. SI-1-LJU-G-555-586
195. *Teucrium arduini* L. XX-0-LJU-G-555-612
196. *Teucrium chamaedrys* L. SI-0-LJU-G-555-613
197. *Teucrium hircanicum* L. XX-0-LJU-G-555-741
198. *Teucrium scorodonia* L. SI-1-LJU-6-997-569
199. *Thymus longicaulis* C.Presl XX-0-LJU-G-999-588
200. *Callicarpa giraldii* Hesse ex Rehder XX-0-LJU-G-555-345
201. *Clinopodium dalmaticum* (Benth.) Bräuchler & Heubl XX-0-LJU-G-000-512
202. *Clinopodium vulgare* L. XX-0-LJU-G-555-2268
203. *Lycopus europaeus* L. SI-0-LJU-G-555-503
204. *Origanum vulgare* L. subsp. *vulgare* SI-0-LJU-G-555-991
205. *Prunella laciniata* (L.) L. XX-0-LJU-G-999-578
206. *Prunella vulgaris* L. XX-0-LJU-G-999-579
207. *Satureja montana* L. subsp. *variegata* (Host) P.W.Ball SI-0-LJU-G-555-580
208. *Vitex agnus-castus* L. XX-1-LJU-G-555-629

Liliaceae

209. *Gagea lutea* (L.) Ker Gawl. SI-0-LJU-G-555-425

Lythraceae

210. *Lythrum salicaria* L. SI-0-LJU-G-555-505

Malvaceae

211. *Gossypium arboreum* L. XX-0-LJU-G-555-446
212. *Gossypium hirsutum* L. XX-0-LJU-G-555-445
213. *Hibiscus coccineus* Walter XX-0-LJU-G-555-455
214. *Hibiscus sabdariffa* L. XX-0-LJU-G-555-674
215. *Lagunaria patersonia* (Andrews) G.Don XX-GZU-83-110127
216. *Malva alcea* L. XX-0-LJU-G-999-572
217. *Pachira aquatica* Aubl. XX-0-LJU-G-999-574
218. *Pavonia spinifex* Cav. XX-0-LJU-G-555-541

Meliaceae

219. *Turraea heterophylla* Sm. XX-0-LJU-G-999-591

Moraceae

220. *Maclura pomifera* (Raf.) C.K. Schneid. XX-0-LJU-G-555-692

Myrtaceae

221. *Psidium cattleyanum* Sabine XX-GZU-YY-110137
222. *Syzygium cumini* (L.) Skeels XX-0-LJU-G-999-587

Nyctaginaceae

223. *Oxybaphus nyctagineus* (Michx.) Sweet XX-0-LJU-G-555-515

Oleaceae

224. *Fraxinus ornus* L. SI-0-LJU-G-555-423
225. *Ligustrum ibota* Siebold XX-0-LJU-G-555-1630

Onagraceae

226. *Oenothera rosea* Aiton XX-0-HOH-SYS-13575

Paeoniaceae

227. *Paeonia daurica* Andrews subsp. *mlokosewitschii* (Lomakin) D.Y.Hong XX-0-LJU-G-999-575
228. *Paeonia officinalis* L. SI-1-LJU-G-555-535
229. *Paeonia peregrina* Mill. XX-0-LJU-G-555-536
230. *Paeonia veitchii* Lynch XX-0-LJU-G-555-2050

Papaveraceae

231. *Chelidonium majus* L. SI-0-LJU-G-555-366
232. *Corydalis cava* (L.) Schweigg. & Körte SI-0-LJU-G-555-381
233. *Corydalis solida* (L.) Clairv. SI-0-LJU-G-555-382
234. *Papaver rhoeas* L. SI-0-LJU-G-555-537

Paulowniaceae

235. *Paulownia tomentosa* (Thunb.) Steud. XX-0-LJU-G-999-576

Petiveriaceae

236. *Rivina humilis* L. XX-0-LJU-G-555-725

Plantaginaceae

237. *Digitalis ferruginea* L. GE-0-JENA-7300040-10
238. *Digitalis lanata* Ehrh. XX-O-LJU-G-999-542
239. *Erinus alpinus* L. XX-0-LJU-G-555-412

240. *Globularia bisnagarica* L. SI-0-LJU-G-003-442
241. *Misopates orontium* (L.) Raf. XX-0-LJU-G-555-516
242. *Veronica austriaca* L. XX-0-LJU-G-555-748
243. *Veronica barrelieri* H.Schott ex Roem. & Schult. Subsp. *barrelieri* Schott ex Roem. & Schult. SI-0-LJU-G-016-1650
244. *Veronica officinalis* L. XX-0-LJU-G-999-592
245. *Veronicastrum virginicum* (L.) Farw. XX-0-LJU-G-555-625

Plumbaginaceae

246. *Limonium coriarium* H.Arnaud XX-0-LJU-G-555-985

Poaceae

247. *Andropogon gerardii* Vitman US-0-NGOET-337
248. *Avena nuda* L. XX-0-LJU-G-999-560
249. *Brachypodium sylvaticum* (Huds.) P.Beauv. SI-0-LJU-G-555-342
250. *Briza maxima* L. XX-0-LJU-G-999-561
251. *Chrysopogon gryllus* (L.) Trin. SI-1-LJU-6-997-756
252. *Melica ciliata* L. SI-0-LJU-G-555-987
253. *Molinia caerulea* (L.) Moench SI-1-LJU-6-997-563
254. *Stipa pennata* L. XX-0-LJU-G-999-586
255. *Triticum aestivum* L. subsp. *spelta* (L.) Thell. XX-0-LJU-G-002-617

Polygonaceae

256. *Rumex sanguineus* L. XX-0-LJU-G-999-581

Primulaceae

257. *Lysimachia vulgaris* L. XX-0-LJU-G-999-571

Ranunculaceae

258. *Anemone hortensis* L. SI-1-LJU-G-555-642
259. *Anemonoides nemorosa* (L.) Holub XX-0-LJU-G-999-559
260. *Anemonoides ranunculoides* (L.) Holub SI-0-LJU-G-555-320
261. *Caltha palustris* L. SI-0-LJU-G-555-346
262. *Clematis recta* L. SI-0-LJU-G-555-374
263. *Eranthis hyemalis* Salisb. SI-1-LJU-G-555-411
264. *Eriocapitella hupehensis* (Lemoine) Christenh. & Byng XX-0-LJU-G-555-319
265. *Helleborus dumetorum* Waldst. & Kit. Ex Willd. Subsp. a*trorubens* (Waldst. & Kit.) Merxm. & Podlech SI-1-LJU-G-555-980
266. *Helleborus odorus* Waldst. & Kit. Ex Willd. XX-0-LJU-G-999-568
267. *Nigella damascena* L. SI-1-LJU-6-997-759
268. *Pulsatilla nigricans* Mill. SI-1-LJU-6-997-762

269. *Ranunculus arvensis* L. XX-0-LJU-G-555-722
270. *Ranunculus millefoliatus* Vahl XX-0-LJU-G-555-564
271. *Thalictrum minus* L. SI-0-LJU-G-555-1017

Rosaceae

272. *Alchemilla vulgaris* L. XX-0-LJU-G-999-557
273. *Crataegus pedicellata* Sarg. XX-0-LJU-G-555-385
274. *Filipendula ulmaria* (L.) Maxim. SI-0-LJU-G-555-421
275. *Fragaria vesca* L. SI-0-LJU-G-555-422
276. *Geum coccineum* Sm. XX-0-LJU-G-555-437
277. *Neillia tanakae* (Franch. & Sav.) Franch. & Sav. Ex S.H.Oh XX-0-LJU-G-555-605
278. *Pyrus pyraster* (L.) Borkh. XX-0-LJU-G-555-563
279. *Rhaphiolepis umbellata* (Thunb.) Makino XX-GZU-YY-110258
280. *Rhodotypos scandens* (Thunb.) Makino XX-0-LJU-G-555-565
281. *Rosa arvensis* Huds. SI-0-LJU-G-555-1007
282. *Rosa gallica* L. SI-O-LJU-G-555-567
283. *Rosa glauca* Pourr. SI-0-LJU-G-555-568
284. *Rosa pendulina* L. SI-0-LJU-G-555-569
285. *Rosa rubiginosa* L. SI-0-LJU-G-017-1642
286. *Rosa rugosa* Thunb. XX-0-LJU-G-555-571
287. *Rosa sempervirens* L. SI-0-LJU-G-555-572
288. *Sanguisorba minor* Scop. XX-0-LJU-G-999-582

Rubiaceae

289. *Psychotria bacteriophila* Valeton XX-0-LJU-G-011-556
290. *Sherardia arvensis* L. SI-1-LJU-6-997-567

Rutaceae

291. *Citrus trifoliata* L. XX-0-LJU-G-555-550
292. *Phellodendron amurense* Rupr. XX-0-LJU-G-555-280

Sapindaceae

293. *Acer monspessulanum* L. XX-0-LJU-G-555-1223
294. *Acer palmatum* Thunb. XX-0-LJU-G-555-1224
295. *Acer pseudoplatanus* L. XX-0-LJU-G-555-634
296. *Acer tataricum* L. SI-1-LJU-G-844-293
297. *Acer tataricum* L. subsp. g*innala* Maxim. XX-0-LJU-G-555-290

Saxifragaceae

298. *Saxifraga paniculata* Mill. SI-0-LJU-G-010-489

Scrophulariaceae

299. *Verbascum nigrum* L. SI-1-LJU-6-997-764

Solanaceae

300. *Datura stramonium* L. XX-0-LJU-G-999-564
301. *Lycium chinense* Mill. XX-0-LJU-G-555-502
302. *Nicandra physalodes* (L.) Gaertn. XX-0-LJU-G-555-525
303. *Nicotiana rustica* L. SI-0-LJU-G-003-526
304. *Solanum dulcamara* L. XX-0-LJU-G-999-585

Styracaceae

305. *Halesia carolina* L. XX-0-LJU-G-555-273

Typhaceae

306. *Typha latifolia* L. SI-0-LJU-G-555-619

Ulmaceae

307. *Zelkova carpinifolia* (Pall.) Dippel XX-0-LJU-G-555-288

Urticaceae

308. *Parietaria officinalis* L. XX-0-LJU-G-555-538

Verbenaceae

309. *Lantana camara* L. XX-0-LJU-G-555-485

Viburnaceae

310. *Viburnum tinus* L. SI-0-LJU-G-017-1652

* Semina plantarum in caladariis cultarum.

Horti praefectus: dr. Jože Bavcon
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Plantae Curator: dr. Blanka Ravnjak

Semina e plantis spontaneis in loco natali anno 2025

Jože Bavcon, Igor Dakskobler, Ljudmila Dakskobler, Branko Dolinar, Katja Malovrh, Jure Kališnik, Janja Makše, Maja Tomšič, Blanka Ravnjak

311. *Achillea clavenae* L. – Sedlo Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-770
312. *Adenostyles glabra* (Miller) DC. – Pl. Baban, Dolina, 2025, L. D., I. D., SI-1-LJU-6-997-771
313. *Agrimonia eupatoria* L. – Belica, 2025, J. B., B. R., SI-1-LJU-6-997-772
314. *Alchemilla velebitica* Borbás – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-773
315. *Allium angulosum* L. – Planinsko polje, 2025, J. B., B. R., SI-1-LJU-6-997-774
316. *Allium victorialis* L. – Porezen, 2025, J. B., B. R., SI-1-LJU-6-997-775
317. *Allium victorialis* L. – Črna prst, 2025, J. B., B. R., SI-1-LJU-6-997-776
318. *Allium victorialis* L. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-777
319. *Anacamptis morio* (L.) R.M.Bateman, Pridgeon & M.W.Chase – Butari, 2025, B. D., SI-1-LJU-6-997-933
320. *Anacamptis pyramidalis* (L.) Rich. – Polog, Srednjica, 2025, L. D., I. D., SI-1-LJU-6-997-778
321. *Anemone narcissiflora* L. – Črna prst, 2025, L. D., I. D., SI-1-LJU-6-997-779
322. *Angelica sylvestris* L. – Kucelj-Čaven, 2025, J. B., B. R., SI-1-LJU-6-997-780
323. *Anthyllis montana* L. subsp. *jacquinii* (Rchb.f.) Rohlena – kapelica Hieronim, 2025, J. B., B. R., SI-1-LJU-6-997-781
324. *Aquilegia nigricans* Baumg. – Nanos, 2025, J. B., B. R., SI-1-LJU-6-997-782
325. *Arabis alpina* L. – Divje babe, 2025, J. B., B. R., SI-1-LJU-6-997-783
326. *Arabis pauciflora* (Grimm) Garcke – Porezen, 2025, J. B., B. R., SI-1-LJU-6-997-784
327. *Arabis turrita* L. – Sabotin, 2025, J. B., B. R., K. M., SI-1-LJU-6-997-785
328. *Artemisia atrata* Lam. – Črna prst, 2025, J. B., B. R., SI-1-LJU-6-997-786
329. *Aruncus dioicus* (Walter) Fernald – Kamniška Bistrica, 2025, J. B., B. R., SI-1-LJU-6-997-787
330. *Asarum europaeum* L. – Vremščica, 2025, J. B., B. R., SI-1-LJU-6-997-788
331. *Asphodelus albus* Mill. – Rajske poljane, 2025, J. B., B. R., SI-1-LJU-6-997-789
332. *Asphodelus albus* Mill. – Nanos-pastirska koča, 2025, J. B., B. R., SI-1-LJU-6-997-790
333. *Asphodelus albus* Mill. – Plato Kojniška, 2025, J. B., B. R., SI-1-LJU-6-997-791
334. *Aster tripolium* Walter – Koper, 2025, J. B., B. R., SI-1-LJU-6-997-792
335. *Athamanta cretensis* L. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-793
336. *Berberis vulgaris* L. – Žejna dolina, 2025, J. B., B. R., SI-1-LJU-6-997-794
337. *Betonica officinalis* L. – Goričko, Motvarjevci, 2025, J. B., B. R.,

SI-1-LJU-6-997-795

338. *Buphthalmum salicifolium* L. – Roje, 2025, B. R., SI-1-LJU-6-997-796
339. *Buphthalmum salicifolium* L. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-797

340. *Cardamine enneaphyllos* (L.) Crantz – Vremščica, 2025, J. B., B. R., SI-1-LJU-6-997-798
341. *Centaurea rupestris* L. – Plato kapelica, 2025, J. B., B. R., SI-1-LJU-6-997-799
342. *Centaurea scabiosa* L. – Rajske poljane, 2025, J. B., B. R., SI-1-LJU-6-997-800
343. *Centaurea scabiosa* L. – Podgorje, 2025, J. B., B. R., SI-1-LJU-6-997-801
344. *Chamerion angustifolium* (L.)Holub – Sedlo Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-802
345. *Cotinus coggygria* Scop. – Piran, 2025, J. K., SI-1-LJU-6-997-803
346. *Crataegus monogyna* Jacq. – Planinsko polje, 2025, J. B., B. R., SI-1-LJU-6-997-804
347. *Crocus vernus* (L.) Hill – Lopata izvoz, 2025, J. B., B. R., SI-1-LJU-6-997-805
348. *Crocus vernus* (L.) Hill - Grad, 2025, J. B., B. R., SI-1-LJU-6-997-806
349. *Crocus vernus* (L.) Hill - Mali Podlog, 2025, J. B., B. R., SI-1-LJU-6-997-807
350. *Dianthus sanguineus* Vis. – Nanos-pastirska koča, 2025, J. B., B. R., SI-1-LJU-6-997-808
351. *Dictamnus albus* L. – Senožeče, 2025, J. B., B. R., SI-1-LJU-6-997-809
352. *Drosera anglica* Huds. – Žejna dolina, 2025, J. B., B. R., SI-1-LJU-6-997-810
353. *Dryas octopetala* L. – Črna prst, 2025, J. B., B. R., SI-1-LJU-6-997-811
354. *Epipactis helleborine* (L.) Crantz – dolina Učja, 2025, L. D., I. D., SI-1-LJU-6-997-812
355. *Epipactis palustris* (L.) Crantz – Žejna dolina, 2025, J. B., B. R., SI-1-LJU-6-997-813
356. *Erigeron uniflorus* L. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-814
357. *Eryngium amethystinum* L. – Rakitovec, 2025, J. B., B. R., SI-1-LJU-6-997-815
358. *Euonymus europaeus* L. – Dragonja, 2025, J. B., B. R., SI-1-LJU-6-997-816
359. *Euonymus latifolius* (L.) Mill. – Kamniška Bistrica, 2025, J. B., B. R., SI-1-LJU-6-997-817
360. *Euonymus verrucosus* Scop. – Kamniška Bistrica, 2025, J. B., B. R., SI-1-LJU-6-997-818
361. *Eupatorium cannabinum* L. – Kucelj-Čaven, 2025, J. B., B. R., SI-1-LJU-6-997-819
362. *Filipendula vulgaris* Moench - Roje, 2025, K. M., SI-1-LJU-6-997-820
363. *Fraxinus ornus* L. – Podgorje, 2025, J. B., B. R., SI-1-LJU-6-997-821
364. *Fraxinus ornus* L. – pod Kavčičami, 2025, J. B., B. R., SI-1-LJU-6-997-822
365. *Galanthus nivalis* L. – Lopata izvoz, 2025, J. B., B. R., SI-1-LJU-6-997-823
366. *Galanthus nivalis* L. – Bošamarin, 2025, J. B., B. R., SI-1-LJU-6-997-824
367. *Galanthus nivalis* L. – Brest, 2025, J. B., B. R., SI-1-LJU-6-997-825
368. *Galanthus nivalis* L. – Grad, 2025, J. B., B. R., SI-1-LJU-6-997-826
369. *Galanthus nivalis* L. – Zminec, 2025, J. B., B. R., SI-1-LJU-6-997-827
370. *Galanthus nivalis* L. – Na Stolbi, 2025, J. B., B. R., SI-1-LJU-6-997-828
371. *Galanthus nivalis* L. – Dol, 2025, J. B., B. R., SI-1-LJU-6-997-829
372. *Galanthus nivalis* L. – Drnovo, 2025, J. B., B. R., SI-1-LJU-6-997-830

373. *Genista radiata* (L.) Scop. – Črna prst, 2025, J. B., B. R., SI-1-LJU-6-997-831
374. *Gentiana asclepiadea* L. – Kamniška Bistrica, 2025, J. B., B. R., SI-1-LJU-6-997-832
375. *Gladiolus illyricus* W.D.J.Koch - Roje, 2025, B. R., SI-1-LJU-6-997-833
376. *Gladiolus illyricus* W.D.J.Koch – Planinsko polje, 2025, J. B., B. R., SI-1-LJU-6-997-834
377. *Gladiolus illyricus* W.D.J.Koch - Ljubljana- Šentvid, 2025, J. B., B. R., SI-1-LJU-6-997-835
378. *Globularia bisnagarica* L. – Senožeče, 2025, J. B., B. R., SI-1-LJU-6-997-836
379. *Globularia bisnagarica* L. – Roje, 2025, B. R., SI-1-LJU-6-997-837
380. *Globularia bisnagarica* L. – Rajske poljane, 2025, J. B., B. R., SI-1-LJU-6-997-838
381. *Globularia cordifolia* L. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-839
382. *Gymnadenia conopsea* (L.) R. Br. – Črni vrh / Cerkno, 2025, J. B., B. R., SI-1-LJU-6-997-840
383. *Gymnadenia conopsea* (L.) R. Br. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-841
384. *Helleborus niger* L. – Belica, 2025, J. B., B. R., SI-1-LJU-6-997-842
385. *Helleborus niger* L. – Rodne, 2025, J. B., B. R., SI-1-LJU-6-997-843
386. *Hypochaeris maculata* L. – Rajske poljane, 2025, J. B., B. R., SI-1-LJU-6-997-844
387. *Inula conyza* DC. – Podgorje, 2025, J. B., B. R., SI-1-LJU-6-997-845
388. *Inula hirta* L. – Rajske poljane, 2025, J. B., B. R., SI-1-LJU-6-997-846
389. *Inula salicina* L. – Podgorje, 2025, J. B., B. R., SI-1-LJU-6-997-847
390. *Iris graminea* L. – Kavčič, 2025, J. B., B. R., SI-1-LJU-6-997-848
391. *Iris sibirica* L. – Goričko, Motvarjevci, 2025, J. B., B. R., SI-1-LJU-6-997-849
392. *Iris sibirica* L. – Kavčič, 2025, J. B., B. R., SI-1-LJU-6-997-850
393. *Juniperus communis* L. – Podgorje, 2025, J. B., B. R., SI-1-LJU-6-997-851
394. *Jurinea mollis* (L.) Rchb. – Rakitovec, 2025, J. B., B. R., SI-1-LJU-6-997-852
395. *Laserpitium latifolium* L. – Slatnik, 2025, L. D., I. D., SI-1-LJU-6-997-853
396. *Laserpitium latifolium* L. – Čaven, 2025, J. B., B. R., SI-1-LJU-6-997-854
397. *Laserpitium peucedanoides* L. – Snežnik, 2025, J. B., B. R., SI-1-LJU-6-997-855
398. *Leontopodium nivale* (Ten.) A.Huet ex Hand.-Mazz. Subsp. *alpinum* (Cass.) Greuter – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-856
399. *Leucanthemum heterophyllum* DC. – Črna prst, 2025, J. B., B. R., SI-1-LJU-6-997-857
400. *Leucojum vernum* L. – Šmartinsko jezero, 2025, B. R., SI-1-LJU-6-997-858
401. *Lilium carniolicum* Bernh. Ex W.D.J.Koch – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-859
402. *Linum viscosum* L. – Roje, 2025, B. R., SI-1-LJU-6-997-860
403. *Lunaria rediviva* L. – Čaven-Kucelj, 2025, J. B., B. R., SI-1-LJU-6-997-861
404. *Lycopus europaeus* L. – Rački ribniki, 2025, J. B., B. R., SI-1-LJU-6-997-862
405. *Lysimachia vulgaris* L. – Selo, Goričko, 2025, J. B., B. R., SI-1-LJU-6-997-863
406. *Lysimachia vulgaris* L. – Žejna dolina, 2025, J. B., B. R., SI-1-LJU-6-997-864
407. *Myrrhis odorata* (L.) Scop. – pastirska , Porezen, 2025, J. B., B. R., SI-1-LJU-6-997-865

408. *Myrrhis odorata* (L.) Scop. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-866
409. *Ophrys apifera* Huds. – Butari, 2025, B. D., SI-1-LJU-6-997-934
410. *Ophrys apifera* Huds. – Kneža, Slatne, 2025, L. D., I. D., SI-1-LJU-6-997-867
411. *Origanum vulgare* L. – Kuželj, 2025, J. B., B. R., SI-1-LJU-6-997-868
412. *Orlaya grandiflora* (L.) Hoffm. – Dragonja, 2025, J. B., B. R., SI-1-LJU-6-997-869
413. *Ornithogalum pyrenaicum* L. – Roje, 2025, B. R., SI-1-LJU-6-997-870
414. *Paliurus spina-christii* Mill. – Dragonja, 2025, J. B., B. R., SI-1-LJU-6-997-871
415. *Parnassia palustris* L. – Žejna dolina, 2025, J. B., B. R., SI-1-LJU-6-997-872
416. *Peucedanum austriacum* (Jacq.) W.D.J.Koch – Snežnik, 2025, J. B., B. R., SI-1-LJU-6-997-873
417. *Peucedanum oreoselinum* Moench – Roje, 2025, K. M., SI-1-LJU-6-997-874
418. *Phyteuma orbiculare* L. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-875
419. *Phyteuma ovatum* Honck. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-876
420. *Phyteuma scorzonerifolium* Vill. – Črni vrh / Cerkno, 2025, J. B., B. R., SI-1-LJU-6-997-877
421. *Phyteuma spicatum* L. – Nanos, 2025, J. B., B. R., SI-1-LJU-6-997-878
422. *Phyteuma spicatum* L. – Porezen, 2025, J. B., B. R., SI-1-LJU-6-997-879
423. *Pistacia terebinthus* L. – Dragonja, 2025, J. B., B. R., SI-1-LJU-6-997-880
424. *Plantago altissima* L. – Planinsko polje, 2025, J. B., B. R., SI-1-LJU-6-997-881
425. *Plantago argentea* Chaix subsp. *liburnica* Ravnik – Nanos, pastirska koča, 2025, J. B., B. R., SI-1-LJU-6-997-882
426. *Plantago maritima* L. – Fiesa, 2025, J. K., SI-1-LJU-6-997-883
427. *Plantago subulata* L. – Nanos, pastirska koča, 2025, J. B., B. R., SI-1-LJU-6-997-884
428. *Pleurospermum austriacum* Hoffm. – Črna prst, 2025, J. B., B. R., SI-1-LJU-6-997-885
429. *Polygonatum latifolium* (Jacq.) Desf. – Kamniška Bistrica, 2025, J. B., B. R., SI-1-LJU-6-997-886
430. *Prenanthes purpurea* L. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-887
431. *Primula auricula* L. – Porezen, 2025, J. B., B. R., SI-1-LJU-6-997-888
432. *Prunus mahaleb* L. – Sočerga, 2025, J. B., B. R., SI-1-LJU-6-997-889
433. *Prunus spinosa* L. – Planinsko polje, 2025, J. B., B. R., SI-1-LJU-6-997-890
434. *Pulsatilla alpina* (L.) Delarbre – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-891
435. *Pulsatilla alpina* (L.) Delarbre subsp. *austroalpina* D. M. Moser – Črna prst, 2025, J. B., B. R., SI-1-LJU-6-997-892
436. *Pulsatilla alpina* (L.) Delarbre subsp. *austroalpina* D.M.Moser – Pl. Baban, Nad Dolino, uravnava pod Veliko Kuhinjo, 2025, L. D., I. D., SI-1-LJU-6-997-895
437. *Pulsatilla montana* (Hoppe) Rchb. – Vremščica, 2025, J. B., B. R., SI-1-LJU-6-997-893
438. *Pulsatilla nigricans* Störck. – Žadovinek, 2025, J. B., B. R., SI-1-LJU-6-997-894
439. *Rosa gallica* L. – Podgorje, 2025, J. B., B. R., SI-1-LJU-6-997-896
440. *Rumex alpinus* L. – Porezen, pastirska koča, 2025, J. B., B. R., SI-1-LJU-6-997-897
441. *Ruscus aculeatus* L. – Dragonja, 2025, J. B., B. R., SI-1-LJU-6-997-898

442. *Salvia glutinosa* L. – Belica-Osilnica, 2025, J. B., B. R., SI-1-LJU-6-997-899
443. *Salvia pratensis* L. – Senožeče, 2025, J. B., B. R., SI-1-LJU-6-997-900
444. *Salvia pratensis* L. – Nanos-Hieronim, 2025, J. B., B. R., SI-1-LJU-6-997-901
445. *Sambucus racemosa* L. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-902
446. *Sanguisorba officinalis* L. – Planinsko polje, 2025, J. B., B. R., SI-1-LJU-6-997-903
447. *Satureja montana* L. – Črni kal, 2025, J. B., B. R., SI-1-LJU-6-997-904
448. *Satureja montana* L. – Rakitovec, 2025, J. B., B. R., SI-1-LJU-6-997-905
449. *Satureja subspicata* Bartl. Ex Vis. Subsp. *liburnica* Šilic – Kucelj, 2025, J. B., B. R., SI-1-LJU-6-997-906
450. *Scabiosa silenifolia* Waldst. & Kit. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-907
451. *Scorzonera aristata* Ramond ex DC. – Črna prst, 2025, L. D., I. D., SI-1-LJU-6-997-908
452. *Scorzonera rosea* Waldst. & Kit. – Porezen, 2025, J. B., B. R., SI-1-LJU-6-997-909
453. *Seseli libanotis* W.D.J.Koch – Čaven, 2025, J. B., B. R., SI-1-LJU-6-997-910
454. *Sesleria autumnalis* (Scop.) F.W. Schultz – Podgorje, 2025, J. B., B. R., SI-1-LJU-6-997-911
455. *Silene alpestre* Jacq. – Porezen, 2025, J. B., B. R., SI-1-LJU-6-997-912
456. *Silene alpestris* Jacq. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-913
457. *Silene flos-cuculi* (L.) Greuter & Burdet – Črni vrh / Cerkno, 2025, J. B., B. R., SI-1-LJU-6-997-914
458. *Silene vulgaris* (Moench) Garcke – Porezen, 2025, J. B., B. R., SI-1-LJU-6-997-915
459. *Siler montanum* Crantz – Čaven, 2025, J. B., B. R., SI-1-LJU-6-997-916
460. *Solidago virgaurea* L. – Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-917
461. *Sorbus aucuparia* L. – Ključ, Brezje pri Dobrovi, 2025, J. K., SI-1-LJU-6-997-918
462. *Stipa pennata* L. – Rakitovec, 2025, J. B., B. R., SI-1-LJU-6-997-919
463. *Succisa pratensis* Moench – Žejna dolina, 2025, J. B., B. R., SI-1-LJU-6-997-920
464. *Succisa pratensis* Moench – Selo, Goričko, 2025, J. B., B. R., SI-1-LJU-6-997-921
465. *Tamus communis* L. – Škofljica, 2025, J. B., B. R., SI-1-LJU-6-997-922
466. *Tragopogon pratensis* L. subsp.*orientalis* (L.) Čelak. – Senožeče, 2025, J. B., B. R., SI-1-LJU-6-997-923
467. *Tragopogon pratensis* L. subsp.*orientalis* (L.) Čelak. – Rajske poljane, 2025, J. B., B. R., SI-1-LJU-6-997-924
468. *Trapa natans* L. – Medvedce, 2025, J. B., B. R., SI-1-LJU-6-997-925
469. *Trifolium noricum* Wulfen – Črna prst, 2025, L. D., I. D., SI-1-LJU-6-997-926
470. *Trolius europaeus* L. – Sedlo Snežnik, 2025, J. B., B. R., M. T., SI-1-LJU-6-997-927
471. *Trollius europaeus* L. – Porezen, 2025, J. B., B. R., SI-1-LJU-6-997-928
472. *Typha latifolia* L. – Medvedce, 2025, J. B., B. R., SI-1-LJU-6-997-929
473. *Typha latifolia* L. – Rački ribniki, 2025, J. B., B. R., SI-1-LJU-6-997-930
474. *Veratrum album* L. subsp.*lobelianum* (Bernh. In Schrader) Suessenguth – Črni vrh / Cerkno, 2025, J. B., B. R., SI-1-LJU-6-997-931
475. *Verbascum austriacum* Schott ex Roem. & Schult. – Kuželj, 2025, J. B., B. R., SI-1-LJU-6-997-932

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ONE HONDRED YEARS OF ALPINE BOTANIC GARDENS JULIANA – ONE HUNDRED YEARS OF CHANGE

Špela Pungaršek

Summary

The Alpine Botanical Garden Juliana, founded in 1926 by the Trieste landowner Albert Bois de Chesne, will celebrate its 100th anniversary in 2026. After the Second World War, the garden gradually came under the administration of the Slovenian Museum of Natural History, where today it significantly contributes to the museum's mission by presenting many rare and endangered plant species. The article presents a brief history of the garden and its role today.

Figure 1: The article is dedicated to the long-time head of the Juliana Alpine Botanical Garden in Trenta, Dr. Nada Praprotnik. (Photo: Ciril Mlinar Cic)

Keywords: Albert Bois de Chesne, alpine botanical garden, education, climate change, alpine plants, Trenta

History of the Garden

The founder of Juliana was Albert Bois de Chesne (1871–1953), who came from a Huguenot family that had moved from France to Switzerland. He was born on July 8, 1871, in Trieste, where he also attended grammar school. There he became interested in botany through the researcher of the Littoral flora and author of an extensive description of the vegetation of the former Austrian Littoral, Eduard Pospichal (1838–1905). With him he explored plants in the Karst and in Istria, visited Trenta for the first time in 1887, and fell in love with the Julian Alps. With the Trenta guide Andrej Komac (1853–1908), he also climbed Mount Triglav. He completed his studies at the Forestry School in Zurich, where his teacher was the botanist Carl Schröter (1855–1939), a founder of geobotany and a researcher of alpine vegetation (Praprotnik, 2011). Bois de Chesne was also a passionate hunter. As early as 1892 he was appointed leaseholder of hunting rights in Trenta, where he ensured that the chamois population recovered sufficiently to be hunted again; he also owned several hunting lodges above Trenta (Bois de Chesne, 2003–2006). After completing his studies, Albert took over his father Eduard's wood-processing company as a forestry engineer. The company owned a steam sawmill at Hrib near Loški Potok (Praprotnik, 2011). In 1900 Albert Bois de Chesne married Giulia Ganzoni (1876–1925), with whom he had three children (Olga, Eduard, and Lily). The family lived most of the time in Trieste. In 1905, as co-owner, he purchased the Cernik estate in Slavonia in present-day Croatia, which included extensive forests and a manor where his family spent holidays. He sold the estate in 1925, after his wife died, and devoted himself to establishing the Alpine botanical garden in Trenta (Bois de Chesne, 2005).


a)

Figure 2: (a) The founder of Juliane hunting in Trenta. (a) Albert Bois de Chesne in 1921. (Photo: Bois de Chesne family archive)


b)

In Trenta, Bois de Chesne purchased land for the garden on the Tožbar property. He chose a sunny slope of Mount Kukla near the Church of St. Mary, where several larger rocks were already present and a few trees were growing. Because there was no natural spring in the garden, a water catchment was built below a nearby waterfall, and the water was led to the garden through pipes; the area was also fenced. By the autumn of 1926, the initial work had been completed. Bois de Chesne named the garden after his wife Giulia—though he may also have chosen the name in honor of the Julian Alps. For the gardener, Albert Bois de Chesne hired Anton Tožbar (1905–1993) from Trenta and sent him to study in Padua. His assistant became Ančka Kavs (1907–2000) from Vrsnik. In the spring of 1927, plants began to be brought into the garden in backpacks and baskets from the surrounding mountains. Most of the plants came from the Eastern and Western Julian Alps, the Friulian hills, the Karst grasslands, and the pre-Alpine region, while some were also brought from the Karawanks and the Kamnik–Savinja Alps. To the left of the entrance they planted foreign species that the founder had obtained from the Western Alps, the Pyrenees, the Apennines, the Atlas Mountains, and the Caucasus. Information about plant localities for Juliana was provided to Bois de Chesne by many Slovenian and foreign botanists, including the head of the Ljubljana Botanical Garden Alfonz Paulin (1853–1942) and his gardener Franc Juvan (1875–1960), Julius Kugy (1858–1944), the teacher and botanist Rajko Justin (1865–1938), and the Trieste botanist Carlo Marchesetti (1850–1926). In the garden, Bois de Chesne attempted to present plant communities as they occur in nature. Kugy wrote that the garden should resemble a botanical walk from an alpine valley to a peak in the Julian Alps, with vegetation belts following one another as they do in nature. Along the fence in the lower part of the garden grew valley flora; higher up were plants of the undergrowth of beech and spruce forests; near the water channel grew plants of moist habitats; and at higher elevations, in rock crevices and scree, alpine flora thrived (Praprotnik, 2011).

Figure 3: One of Juliana's first plans. Photo: Archives of the Slovenian Museum of Natural History

After the capitulation of Italy, the garden was no longer accessible to Bois de Chesne; nevertheless, the gardeners continued to care for it as best they could. After the Second World War, many Slovenian natural scientists advocated for the garden. Between 1949 and 1953, the professional management of the garden was taken over by the Slovenian Museum of Natural History in Ljubljana. Its director and nature conservation officer, Angela Piskernik (1886–1967), worked to ensure that Juliana would be restored, properly maintained, and legally protected, which she achieved in 1951 (Anonymus, 1951). The decree also mentioned the possibility of enlarging the garden so that it could extend to the rock face of Mount Kukla and include an arboretum (a collection of trees). However, as a special commission determined that the garden placed too great a financial burden on the Museum of Natural History, in 1953 it was transferred to the administration of various local organizations. Juliana was first managed by the Tolmin Municipal People's Committee, later also by the Bovec Municipal People's Committee and the Goriška Tourist Association. In 1958, with the cooperation of the Institute for Monument Protection, more regular and systematic maintenance of the garden began. The following year, restoration work started under the leadership of the horticulture expert Ciril Jeglič (1897–1989), and from 1960 onward the new museum curator for botany, Tone Wraber, also assisted in these efforts. In 1961, with funds from the Cultural Activities Promotion Fund, the Museum of Natural History resumed management of the garden. Through a contract between the Tolmin Municipal People's Committee and the Museum of Natural History in Ljubljana, on January 1, 1962, Juliana finally came under the administration of the museum (Praprotnik, 2011, 2012).

a)

b)

c)

Figure 4: Botanists from the Slovenian Museum of Natural History in Ljubljana and the Forestry Institute organized two excursions to the Julian Alps, where they collected plants and planted them in the Juliana Garden. Photographs from June 11, 1949, have been preserved in the archives of the Slovenian Museum of Natural History.
(a) Among those assisting in the work were: Franc Šuštar (1923–2016), then a biology student and later a professor of botany; the museum preparator Franc Barbič; and the zoologist Janez Hoenigman (1920–1999).
(b) The planting was also joined by Ana Budnar (1915–2004), curator for botany at the Museum of Natural History in Ljubljana.
(c) In the center of the photograph is Angela Piskernik standing in front of the entrance to the garden; next to her are Ana Budnar, Franc Barbič, Janez Hoenigman, Savo Brelih, and Franc Šuštar.
Photo: Archives of the Slovenian Museum of Natural History.

In the first years under the museum's administration, the professional management of the garden was taken over by the curator for botany, Tone Wraber, who officially cared for it until 1968. He continued to assist the staff with advice even later, during the period between 1968 and 1975 when the museum did not have a curator for botany. In 1967 Anton Tožbar also retired and passed the work on to his daughter Marija and his son-in-law Jože Završnik. Marija began working in the garden in 1965 and retired in 2004; after her husband's death in 2006, she continued working in the garden for another ten years. Jože Završnik moved to Trenta from Dobrovlje in the Savinja Valley. As a trained gardener, he began working in the garden in 1970 and enjoyed telling visitors about the history of the garden, its plants, and Trenta. Since 2004, the family tradition has been continued by Klemen Završnik, a graduate engineer of agronomy and horticulture. In this way, the descendants of the Tožbar family have been caring for the garden since its establishment (Praprotnik, 2011, 2012).

Figure 5: The garden did not have an entrance house until 2004, so the gardeners had no shelter in it. The entrance fee was collected at a large cash register, which also served as a counter. (Photo: Završnik Family Archives)

Figure 6: Marija Završnik with her sister Marta and son Klemen on Juliana's 90th birthday. (Photo: Ciril Mlinar Cic)

In 1975, Nada Praprotnik (1975–2023) became the curator for botany at the Slovenian Museum of Natural History and the professional head of the Juliana Garden. She wrote four guidebooks about the garden, produced a film about it together with Ciril Mlinar – Cico, and organized numerous guided tours there. She presented Juliana to the public through lectures, exhibitions, and media appearances. The garden also became one of the stops visited by school pupils during the traditional Belar Days, which have been organized by the Triglav National Park since 1999 around May 24, the European Day of Parks, in honor of the seismologist and initiator of the park's establishment, Albin Belar (1864–1939). She also oversaw the construction of the entrance building with a canopy, which was built in 2004, and arranged for electricity to be installed in the garden. She also participated in the preparation of an identification key for the plants of Juliana. Under her leadership, the garden became a well-visited attraction in the Trenta Valley and gained recognition both in Slovenia and abroad (Praprotnik, 2011; Pungaršek et al., 2022).

Figure 7: Nada Praprotnik leading the group at the Belar Days. (Photo: Jože Mihelič)

Climate in Trenta and the Plants in the Garden

Albert Bois de Chesne intended to arrange the garden according to ecological principles, so that each bed would represent a fragment of a plant community as it can be observed in nature. However, due to the strong influence of the Mediterranean Sea, which reaches up the Soča Valley, the climate in Juliana is very mild. This does not suit many alpine species, while it provides better conditions for Karst plants (Praprotnik, 2011). As a result, some plants do not grow in their characteristic communities but instead grow in places that best suit their needs. Gardeners must make considerable efforts to create conditions similar to those at the plants'

natural habitats. Spring begins much earlier in the garden than in the mountains; therefore, many alpine plants bloom earlier at higher elevations than they do in the garden. Winters without snow are also unfavorable for the plants, since snow normally acts as insulation and provides water at the time when plants begin to develop. Some plants in the garden have thrived for many years, while others must be replaced every few years either with seedlings collected from nature or grown from seeds. The appearance of the garden changes completely every two weeks, or even every week. Some plants are just opening their flowers, while others are already producing seeds.

Although Julius Kugy wrote in his books that certain high-mountain plants grow successfully in the garden, such as Zois's bellflower (*Campanula zoysii*), moss campion (*Silene acaulis*), and Triglav forget-me-not (*Eritrichium nanum*; Kugy, 1930, 1931), today these species unfortunately survive there only with great difficulty. Despite various methods of winter protection and many tested planting sites within the garden, these species die very quickly and usually do not survive until the following season. Although Praprotnik (2011) writes that Triglav cinquefoil (*Potentilla nitida*) produces a few flowers in the garden every year, in recent years this species has rarely bloomed. On the other hand, the conditions in Juliana are very suitable for plants originating from dry Karst grasslands. In recent years, alpine knapweed (*Centaurea alpina*) and common asphodel (*Asphodelus albus*) have flowered regularly, and various species of viper's-grass (*Scorzonera austriaca*, *S. villosa*) also grow well. The success of plants in the garden is also influenced by climate change. The average annual temperature in Bovec is 10°C, and over the past 30 years it has increased by 1°C. In the last 20 years, five tropical nights have also been recorded in Bovec, when the temperature did not drop below 20°C even at night (ARSO, Trenta measuring station). Annual precipitation in the Soča Valley amounts to 2600 mm and is generally stable, decreasing only during the summer months from June to August (ARSO; Bovec measuring station, average for the period 1981–2010). However, the form of precipitation has also changed. Sixty years ago, the Trenta Valley was covered with snow for about 100 days per year, whereas today this number has been reduced by half, with snow covering the plants for only about 50 days annually (ARSO, Trenta measuring station). Since the snow cover protects plants from frost and represents an important source of water, this may partly explain the poorer survival of high-mountain plants in the garden. When this is combined with the lack of precipitation during the summer months, it undoubtedly has a significant impact on the plants.

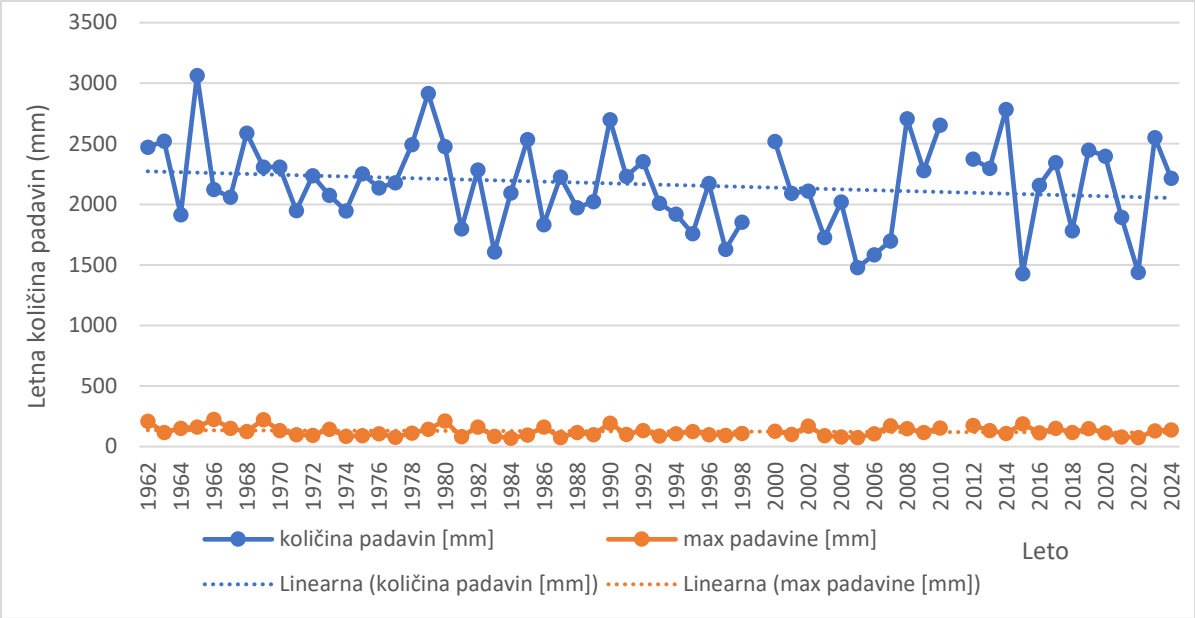
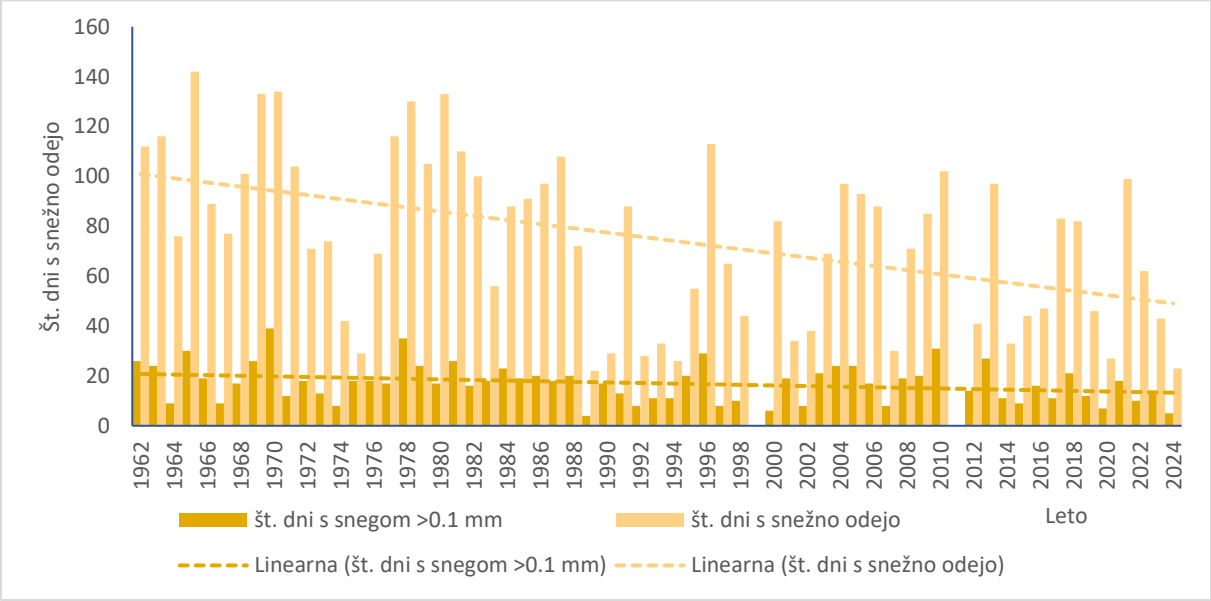


Figure 8: The long-term average annual precipitation in Trenta is around 2200 mm with a slight decreasing trend over the last 60 years. Source: ARSO, Trenta precipitation measuring station.



Slika 9: Less and less precipitation in Trenta is in the form of snow; in the last 60 years, the number of days with snow cover has halved, falling from 100 to 50 days. Source: ARSO, Trenta precipitation measuring station.

The Role of Juliana Today

Juliana is the oldest alpine botanical garden in Slovenia. Since 1951 it has been protected as a monument of designed nature, and in 2004 it was also included in the Register of Natural Values of Slovenia. In 2010, with the adoption of the Triglav National Park Act, it became part of the park's core protected areas (Praprotnik, 2011).

Juliana is part of the Slovenian Network of Botanical Gardens and Arboreta and is also a member of several international associations, including Alpine and Arctic Botanical Gardens, Botanic Gardens Conservation International (BGCI), and the International Plant Sentinel Network (IPSN). Each year, the garden participates in many events organized by Triglav National Park and other botanical gardens.

The alpine botanical garden is a true open-air classroom, where visitors can learn about plant species typical of the alpine and pre-alpine regions of the Slovenian Alps, as well as the dry grasslands of the Slovenian Littoral and Istria. In recent years, the garden has also been equipped with informational panels about lichens, mosses, endemic plants, and useful plants, as well as about fossils and animals that visitors may observe in the garden and its surroundings. Around 700 plant species have been recorded in Juliana. Among them, 67 species are protected in Slovenia under the Decree on Protected Wild Plant Species (Anonymus, 2004a), while 62 species are listed on the Red List (Anonymus, 2002). Natura 2000 is a European ecological network aimed at conserving biodiversity. In Slovenia, Natura 2000 areas cover 37% of the national territory and are based on the Birds Directive and the Habitats Directive. Within the framework of the latter, 27 plant species are protected in Slovenia through designated conservation areas (Anonymus, 2004b). Of these, 10 species grow in Juliana.

The garden is also home to about 20 species that are endemic to at least part of the Slovenian territory, although their distribution often extends beyond Slovenia's borders. In this way, visitors can observe many of Slovenia's botanical specialities in one place.

Figure 10: The plants in the garden are marked with plaques stating the family, scientific, Slovenian, English and German name, and flowering time. They are also shown with their photographs and a distribution map, which mostly represents the countries in which the species thrives; only for species that have a very limited distribution, their actual range is shown.

Figure 11: In 2021, at the initiative of Klemen Završnik, the Cojzek Trail was created in the Garden, where visitors can listen to the dwarf Cojzek in three languages, telling them some interesting facts about the garden, from information about the founder and gardeners to famous plants.

a)

b) **c)**

Figure 12: (a) The garden offers public guided tours and guided tours for announced groups. (b) For families, a children's guidebook, Škrat Cojzek explores Juliana, and worksheets with stickers adapted to the plants that bloom at a certain time of year are available for independent exploration of the garden. (c) Visitors can borrow a guidebook, 99 Plants of the Alpine Botanical Garden Juliana in Trenta, free of charge upon entry.

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Semina in horto alpino Juliana Museum historiae naturalis Sloveniae anno 2025 lecta

Špela Pungaršek, Monika Poklukar in Klemen Završnik

476. *Achnatherum calamagrostis* (L.) P.Beauv.
477. *Adenophora liliifolia* (L.) A. DC.
478. *Allium ericetorum* Thore
479. *Allium schoenoprasum* subsp. *alpinum* (DC.) Nyman
480. *Allium lusitanicum* Lam.
481. *Angelica sylvestris* L.
482. *Anthericum ramosum* L.
483. *Aquilegia einseleana* Fr.Schultz
484. *Aquilegia nigricans* Baumg.
485. *Aruncus dioicus* (Walter) Fernald
486. *Astrantia carniolica* Wulfen
487. *Astrantia major* subsp. *major* L.
488. *Buphthalmum salicifolium* L.
489. *Caltha palustris* L.
490. *Campanula glomerata* subsp. *glomerata* L.
491. *Centaurea scabiosa* subsp. *fritschii* (Hayek) Hayek
492. *Chamaecytisus hirsutus* (L.) Link
493. *Cirsium erisithales* (Jacq.) Scop.
494. *Cirsium oleraceum* (L.) Scop.
495. *Cirsium pannonicum* (L.f.) Link
496. *Cirsium x linkianum* M.Loehr
497. *Clematis recta* L.
498. *Coronilla coronata* L.
499. *Corydalis cava* (L.) Schweigg. & Körte
500. *Crepis alpestris* (Jacq.) Tausch
501. *Crepis froelichiana* subsp. *dinarica* (Beck) Gutermann
502. *Dactylorhiza maculata* subsp. *fuchsii* (Druce) Hyl.
503. *Dianthus barbatus* subsp. *barbatus* L.
504. *Dianthus carthusianorum* subsp. *carthusianorum* L.
505. *Dianthus sternbergii* Sieber ex Capelli
506. *Digitalis grandiflora* Mill.
507. *Dorycnium germanicum* (Gremli) Rikli
508. *Dryas octopetala* L.
509. *Epilobium montanum* L.
510. *Epilobium parviflorum* (Schreb.) Schreb.
511. *Epipactis atrorubens* (Hoffm.) Besser
512. *Erica carnea* L.
513. *Erigeron acris* L.

514. *Erinus alpinus* L.
515. *Eryngium alpinum* L.
516. *Eryngium amethystinum* L.
517. *Euonymus europaeus* L.
518. *Eupatorium cannabinum* L.
519. *Festuca laxa* Host
520. *Filipendula ulmaria* (L.) Maxim.
521. *Galium boreale* L.
522. *Genista radiata* (L.) Scop.
523. *Gentiana asclepiadea* L.
524. *Geranium macrorrhizum* L.
525. *Geranium pratense* L.
526. *Geum urbanum* L.
527. *Gladiolus illyricus* W.D.J.Koch
528. *Grafia golaka* (Hacq.) Rchb.
529. *Helleborus niger* L.
530. *Helleborus odorus* Waldst. & Kit. Ex Willd.
531. *Hemerocallis lilioasphodelus* L.
532. *Hieracium murorum* L.
533. *Hieracium pilosella* L. (*Pilosella officinarum* F.W.Schultz & Sch.Bip.)
534. *Hieracium piloselloides* Vill. (*Pilosella piloselloides* (Vill.) Soják)
535. *Hieracium porrifolium* L.
536. *Hypericum perforatum* L.
537. *Hypochaeris maculata* L.
538. *Iris graminea* L.
539. *Iris sibirica* subsp. *sibirica* L.
540. *Laserpitium latifolium* L.
541. *Laserpitium siler* L. (*Siler montanum* Crantz)
542. *Lathyrus pannonicus* subsp. *varius* (Hill) P.W.Ball
543. *Leontodon hispidus* L.
544. *Leontodon incanus* (L.) Schrank
545. *Lilium carniolicum* Bernh. Ex W.D.J.Koch
546. *Lilium martagon* L.
547. *Linum flavum* L.
548. *Mentha longifolia* subsp. *longifolia* L.
549. *Muscari botryoides* (L.) Mill.
550. *Narcissus poeticus* subsp. *radiiflorus* (Salisb.) Baker
551. *Neottia nidus-avis* (L.) Rich.
552. *Orchis militaris* L.
553. *Paeonia officinalis* L.
554. *Petasites paradoxus* (Retz.) Baumg.
555. *Peucedanum oreoselinum* Moench
556. *Peucedanum verticillare* Spreng.
557. *Phyteuma scheuchzeri* All.
558. *Primula elatior* Hill.
559. *Pulsatilla montana* (Hoppe) Rchb.

560. *Ruta graveolens* L.
561. *Salvia glutinosa* L.
562. *Sanguisorba officinalis* L.
563. *Satureja subspicata* subsp. *liburnica* Šilic
564. *Saxifraga hostii* Tausch
565. *Lomelosia caucasica* (M.Bieb.) Greuter & Burdet
566. *Lomelosia graminifolia* (L.) Greuter & Burdet
Scabiosa hladnikiana Host (*Scabiosa cinerea* subsp. *hladnikiana* (Host) Jasiewicz)
567. *Scorzonera villosa* Scop.
568. *Senecio barbareifolius* Rchb. ((Bertol.) Fourr.)
569. *Sibiraea croatica* Degen (*Sibiraea laevigata* (L.) Maxim.)
570. *Silene nutans* L.
571. *Spiraea decumbens* W.D.J.Koch
572. *Betonica officinalis* L.
573. *Taraxacum officinale* agg.
574. *Telekia speciosa* (Schreb.) Baumg.
575. *Thalictrum minus* subsp. *minus* L.
576. *Trollius europaeus* L.
577. *Tussilago farfara* L.
578. *Valeriana tripteris* L.
579. *Veronica urticifolia* Jacq.
580. *Vicia oroboides* Wulfen

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Hortulani: Monika Poklukar, Klemen Završnik

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