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CONDITION AND PHENOLOGY OF INTRODUCED PINE SPECIES IN THE TURKESTAN RANGE

Khamroev Kh.F.,
Turatov M.N.

Abstract: This article provides data on the current state and phenology of the trees of the ninabargic wood species (Scots pine, Crimean pine, Norway spruce, Schrenk spruce, Siberian larch, and Siberian fir), which are introduced to the territory of the lake of the Turkestan Range.
The article provides data on the fact that the introduced species of ninabarg trees grow well in the territory, and the duration of the growing season was 183-192 days.

Although mountains cover only 12% of the Earth's surface, they provide 60% of the world's fresh water supply. Mountain forests have a significant impact on the quantity and quality of water consumed by mountain and lowland populations, as well as by industries. When mountain forests are cut down and the land is left unprotected, soil erosion increases, which degrades the quality of water in canals and rivers. Many cities around the world rely on mountain water. For example, 95% of Vienna's water comes from the mountain forests of the Northern Alps. 40% of the water in Tegucigalpa, Honduras, comes from the cloud forests of La Tigra National Park. In Kenya, water from Mount Kenya produces 97% of its hydroelectric power. In Asia, the Tibetan Plateau provides water to approximately three million people [6].

As of March 2023, the world's mountain forests are under threat. Scientists claim that since 2001, the area of mountain forests has decreased by 7%, or 78 million hectares. Deforestation, the expansion of agricultural land, and fires are the main causes of rapid loss of tree cover [7].

The use of introduced species is important for expanding the area of these forests and improving existing ones. It will also enhance the recreational use of forests in mountainous regions [4-5].

Ancient spruce remains are known from the Cretaceous period, and later from the Pliocene and Pleistocene periods, and have been found in Europe, Asia, and North America [1-2]. Esipova T.V. reports that the remains of black pines have been found in the Eocene deposits of England, as well as in Alaska and the Baltic region [3].

Phenological studies are of great importance in the study of introduced plants. Phenological observations provide great assistance in determining the beginning of the growing season in trees, the transition to different phases, the number of days between them, and the sum of favorable temperatures. Phenological observations also contribute to a comprehensive study of fruit formation in plants, increased seed productivity, the influence of external factors, and changes throughout the growing season [1-3].

In order to expand the range of tree species used in the creation of protective plantations in the mountainous regions of our republic, the cultivation of species belonging to the pine family (Pinaceae) began in the Kulsai section of the Turkestan Range in 1970, and it can be noted that they have survived to this day, meaning that they continue to grow and develop.

In addition to the Kulsai section of the Turkestan Range, landscaping projects using these species were also carried out in the Zamin sanatorium. Conifers in the Zamin sanatorium are considered mature and planted as seedlings.

All coniferous trees in the Kulsoy area were planted according to a 3x2 m scheme on an area of 4 hectares, including 0.24 hectares of Scots pine, 0.54 hectares of Crimean pine, 0.42 hectares of Norway spruce, 1.26 hectares of Siberian spruce, 0.12 hectares of Siberian larch, and 1.42 hectares of Siberian larch.

Table 1

Area and condition of some introduced pine forests in the Kulsoy area of the Turkestan Range

№	Types of trees	Landing pattern, m	Area, ha	Condition
1	Common pine	3x2	0,24	good
2	The Crimean Pine	3x2	0.54	good
3	Common spruce	3x2	0.42	good
4	Schrenk's Spruce	3x2	1,26	good
5	Siberian Fir	3x2	0.12	good
6	Siberian Larch	3x2	1,42	good
	Total		4,0	

The general condition of the plantations formed by these species is assessed as good and continues to grow at the present time, i.e. all species have an annual growth.

Our studies have shown that the introduced species in the Kulsoy area of the Turkestan Range are doing well and continue to grow today.

The studies have shown that the growth and development of Pinaceae species during the growing season, the number of days it takes for the species to transition from one phase to another, and the favorable temperatures required for their growth. These species are trees, and they have a long growing season. Below, we will discuss the phenological phases of the introduced deciduous tree species found in the Kulsoy area [4-5].

Bud break in Scots pine was observed on 06.04.2022, 08.04.2023, and 10.04.2024, with an average air temperature of +6.2°C. The branches began to grow on April 14, 2022, April 16, 2023, and April 22, 2024, with an average temperature of +12.4°C. The beginning of pineapple leaf formation is mainly observed during periods when the average air temperature is between +15.2°C and +17.1°C, and this period coincided with 12.05 in 2022, 15.05 in 2023, and 20.05 in 2024. Pollination began simultaneously with the formation of stamens in the Scots pine, and this period occurred on May 10 in 2022, May 12 in 2023, and May 16 in 2024.

From the end of May to the first ten days of June, the growth of Scots pine branches stopped in the region. The formation of growth buds was observed in the third ten days of June and the first ten days of July, and the complete lignification of branches was observed in the third ten days of September and the first ten days of October.

The onset of phenological phases in the Crimean pine was relatively late compared to the Scots pine: bud break was observed on April 8, 2022, April 10, 2023, and April 11, 2024, with an average air temperature of +6.4°C. The branches began to grow on April 18, 2022, April 18, 2023, and April 23, 2024, with an average temperature of +12.6°C. The beginning of stamen formation was observed mainly during periods when the average air temperature was between +15.2°C and +17.1°C, which occurred on May 14, 2022, May 15, 2023, and May 22, 2024. In the Crimean pine, as well as in the Scots pine, the beginning of pollination was observed simultaneously with the beginning of stamen formation, and this period occurred on May 12, 2022, May 14, 2023, and May 20, 2024.

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Fig. Status of introduced coniferous trees in experimental plots (2022–2024)

In the Norway spruce and Siberian spruce, bud break occurred on April 6 and April 10, 2022, April 7 and April 12, 2023, and April 9 and April 13, 2024, respectively. The air temperature was recorded at +6.5°C. In these species, branch growth began on 14.04, leaf formation began on 16.05, pollination began on 14.05, branch growth ceased on 02.06, growth buds formed on 02.07, and branches became fully woody on 02.10.

The beginning of the vegetation of the region's tree species was observed in 2023 and 2024. In 2023, the vegetation of the Scots pine began on April 4, the Crimean pine and Siberian larch on April 6, the Norway spruce on April 7, and the Schrenk pine and Siberian fir on April 12. In 2024, this period began 1-2 days later. The end of the growing season for all breeds coincided with the second and third decades of October, and the growing season lasted 183-193 days. At the same time, the duration of the common pine vegetation was 190–192 days, the Crimean pine – 183–190 days, the common spruce – 184–193 days, the Schrenk spruce – 189–187 days, the Siberian fir – 185–191 days, and the Siberian larch – 186–187 days. (Table 2).

Table 2

Development of coniferous trees during the growing season

Types of trees	The growing season	The growing season, day	Duration of shoot growth, day	Annual growth, cm

	2023	2024	2023	2024	2023	2024	2023	2024
Common pine	04.04 12.10	06.04 12.10	192	190	54	66	6.4	5.8
The Crimean Pine	06.04 05.10	08.04 14.10	183	190	58	68	10.6	11.4
Common spruce	07.04 08.10	09.04 18.10	184	193	52	64	4.3	4.6
Schrenk's Spruce	12.04 16.10	13.04 16.10	189	187	50	60	4.2	4.1
Siberian Fir	12.04 12.10	13.04 20.10	185	191	52	61	5.3	5.7
Siberian Larch	06.04 08.10	07.04 22.10	186	187	56	65	5.8	6.1

It was noted that the duration of branch growth was 50–68 days, and the largest growth was observed in the Crimean pine. It was established that the duration of branch growth in the Crimean pine was 58–68 days, which is 2–8 days longer than in other species. Consequently, the annual growth rates are also high: the annual growth of the Crimean pine was 10.6 cm in 2023 and 11.4 cm in 2024 (Table 2).

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