

Cone-bearing of Siberian stone pine (*Pinus sibirica* Du Tour) under conditions of introduction in Bashkir Cis-Urals and the South Urals

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Плодоношение кедра сибирского (*Pinus sibirica* Du Tour) в условиях интродукции в Башкирском Предуралье и на Южном Урале Путенихина К. В.¹, Шигапов З. Х.², Путенихин В. П.³

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Abstract: the level of tree and stand cone-bearing of Siberian stone pine (*Pinus sibirica* Du Tour) under introduction at the territory of Bashkir Cis-Urals and the South Urals is considered in the article for the period from 2011 to 2013.

Аннотация: в статье характеризуется уровень плодоношения в 2011-2013 гг. деревьев и насаждений кедра сибирского (*Pinus sibirica* Du Tour) при интродукции на территории Башкирского Предуралья и Южного Урала.

Keywords: siberian stone pine, trees, stands, cone-bearing, cone yield, Bashkir Cis-Urals, the South Urals.

Ключевые слова: сосна кедровая сибирская, деревья, насаждения, плодоношение, урожай шишек, Башкирское Предуралье Южный Урал.

The main works on establishment of artificial silvicultural stands of Siberian stone pine (*Pinus sibirica* Du Tour) in the Republic of Bashkortostan (Bashkir Cis-Urals and the South Urals) were carried out during 1950-1970s. The first stand was created in 1904-1907 near the town of Beloretsk in mountain-forest zone of the South Urals [6, 11]. By the middle of 1970s the total planting area reached 543 ha [5, 13]. Nowadays at the territory of Bashkortostan there are about 105 silvicultural sites of Siberian stone pine with total area of about 345 ha [9]. Single trees and groups are also found in landscaping, in particular in Ufa city (Bashkir Cis-Urals) [1, 8, 14].

At the present time there is an urgent necessity to study biological peculiarities of Siberian stone pine in the region. The important indicator of introduction steadiness of plant species is the ability to form generative organs under new conditions of growth. The aim of our research was to estimate cone-bearing level in Siberian stone pine trees and stands in Bashkir Cis-Urals and the South Urals for the period from 2013 to 2015. In Ufa city the research was fulfilled in 2 sites. Siberian stone pine located in Botanical Garden-Institute of Ufa Scientific Center is represented by 3 tree groups of different age (from 22 to 75 years) [1, 14]. The second site in Ufa is Sanatorium of «Green grove» consisting of 55-year old trees.

For the study of cone-bearing of silvicultural stands 10 sites were taken in plain-lowland Cis-Urals and 7 ones – in mountains of the South Urals. The age of most stands is 42-65 years (one stand is about 100 years). Five-score scale by Kapper [4] is used for cone-bearing (cone yield) evaluation. In Botanical Garden and Sanatorium the cone yield of each tree was fixed. The cone yield of stands was determined on the base of 10 trees per stand.

The obtained results for separate trees in Botanical Garden and Sanatorium in Ufa are presented in Table 1. In general, the level of cone-bearing during 3-year period is estimated as weak. It was somewhat more in 2014 and 2015. Young generative trees planted in 1991 and 2003 are characterized by the lowest scores of cone yield. The cone-bearing level of mature generative trees is somewhat higher in Sanatorium than in Botanical Garden. Separate trees differ from each other by the level and stability of cone yield.

The data obtained for silvicultural sites show (Table 2) that cone-bearing in stands is characterized by better values in comparison with the trees in urban conditions. But in general, cone-bearing ability of stands for the period of 2013-2015 is also estimated by not high values (scores I-II). However, we may distinguish some sites giving more cones annually: there are Karaidel and Yumatovo sites in Bashkir Cis-Urals as well as old-aged site of Beloretsk-2 and grafted site of Beloretsk-4 in the South Urals. Cone-bearing of some trees in these sites is evaluated by score III. It should be noted that seed material collected by us in Yumatovo site has rather high values of seed germination ability (up to 68 %) [10, 12].

According to literature data [2, 3, 7, 15], cone yield of trees and stands in plantation and introduction cultures of II-IV classes of age (40-80 years old) is not usually large. Besides, just as in our case a quantity of forming cones varies depending on type of location, meteorological conditions of the year and age of trees.

Table 1. Cone-bearing scores in Siberian stone pine separate trees in 2013-2015

Trees	2013	2014	2015	Average (limits)
Generative trees planted in 1944 (biological age is 75 years old) – Ufa Botanical Garden (BG)				
1-BG/1944	0	0	0	0
2-BG/1944	0	0	0	0
3-BG/1944	0	0	0	0
4-BG/1944	0	I	I	0,7 (0-I)
5-BG/1944	0	0	I	0,3 (0-I)
6-BG/1944	I	I	0	0,7 (0-I)
7-BG/1944	I	I	I	1,0 (I-I)
8-BG/1944	0	I	I	0,7 (0-I)
9-BG/1944	I	0	I	0,7 (0-I)
Average (limits)	0,3 (0-I)	0,4 (0-I)	0,6 (0-I)	0,4 (0-I)
Generative trees planted in 1964 (55 years) – Ufa Sanatorium of «Green grove» (GG)				
10-GG/1964	0	I	I	0,7 (0-I)
11-GG/1964	I	I	I	1,0 (I-I)
12-GG/1964	I	I	I	1,0 (I-I)
13-GG/1964	I	I	I	1,0 (I-I)
14-GG/1964	I	I	I	1,0 (I-I)
Average (limits)	0,8 (0-I)	1,0 (I-I)	1,0 (I-I)	0,9 (0-I)
Young generative trees planted in 1991 (37 years) – BG				
15-BG/1991	0	I	I	0,7 (0-I)
16-BG/1991	0	0	0	0
17-BG/1991	0	0	0	0
Average (limits)	0	0,3 (0-I)	0,3 (0-I)	0,2 (0-I)
Young generative and virginal trees planted in 2003 (22 years) – BG				
18-BG/2003	0	0	0	0
19-BG/2003	0	0	I	0,3 (0-I)
20-BG – 42-BG/2003	0	0	0	0
Average (limits)	0	0	0,04 (0-I)	0,01 (0-I)

Thus, cone-producing capacity of Siberian stone pine under natural-climatic conditions of Bashkir Cis-Urals and the South Urals indicates a certain adaptation of the species and perspective of its wider use for afforestation in the Republic of Bashkortostan.

Table 2. Cone-bearing scores in Siberian stone pine artificial stands in 2013-2015

Site	2013	2014	2015	Average (limits)
Bashkir Cis-Urals				
Askino	-*	-	I (0-I)	1,0 (0-I)
Bakaly	0	I (0-I)	I (0-I)	0,7 (0-I)
Birsk	0	II (0-II)	I (0-I)	1,0 (0-II)
Karaidel	I (0-II)	II (0-II)	II (0-III)	1,7 (0-III)
Mishkino	0	I (0-I)	II (0-II)	1,0 (0-II)
Sterlitamak	I (0-I)	II (0-II)	I (0-II)	1,3 (0-II)
Tatyshly	0	I (0-I)	I (0-I)	0,7 (0-I)
Tuymazy	0	I (0-I)	I (0-I)	0,7 (0-I)
Yumatovo	II (I-III)	II (0-II)	II (0-III)	1,0 (0-III)
Yanaul	0	I (0-I)	I (0-I)	0,7 (0-I)
Average (limits)	0,4 (0-II)	1,4 (I-II)	1,3 (I-II)	1,1 (0,7-II,0)
the South Urals				
Beloretsk-1	0	I (0-I)	I (0-I)	0,7 (0-I)
Belortsk-2 (110 years)	I (0-I)	II (0-II)	II (0-III)	1,7 (0-III)

Beloretsk-3	-	II (0-II)	I (0-II)	I,5 (0-II)
Beloretsk-4 (grafted site)	-	-	II (I-III)	II,0 (I-III)
Burzyan	-	I (0-I)	0 (0-I)	0,5 (0-I)
Salavat-Lakly	I (0-I)	I (0-I)	I (0-I)	I,0 (0-I)
Uchaly	-	I (0-II)	II (0-II)	I,5 (0-II)
Average (limits)	I,0	I,3 (I-II)	I,3 (0-II)	I,3 (0,5-II,0)

Note: * no data

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