

MORPHOLOGICAL CHARACTERISTICS OF SIBERIAN FIR POLLEN IN MONGOLIA

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Abstract. *Until now, a comprehensive study on the habitat, morphology, biology and ecology of Siberian fir, on extension of natural forest ranges, promotion of non-native plantations, propagation by seeds in arboretums, also on planting Siberian firs for forestry and horticulture has not been undertaken in Mongolia. Thus, this study is considered essential and important nowadays.*

The study aims to analyze morphological features of pollen of Siberian fir in mountain plantations of Mongolia. In this respect, qualitative and quantitative parameters that are most typical for this type have been examined. Also, variations of Siberian fir pollen that are most valuable for the forestry have been identified.

We have investigated pollen morphological characteristics in respect to their shape, size, whereas apertures were examined in terms of outer wall or exine composition and modification according to the methodology of Kupriyanova, Alyoshina (1972, 1978, 1983), Sladkov (1967), T.N.Nekrasova (1983), R.G.Kurmanov, A.R.Ishbridin (2013), M.O.Oshurkova (2014), S.Jamyansuren (2012) and Mamayev (1972). 96 pollen grains were collected for three repeated testing with 32 pollens per each repeat. "CG Performance [768X576]" program was used to capture pollen images, and J.MIVNT Micro-Image Analysis system, WV-CP240EXCH camera, XSP-8CA microscope, as well as Excel-2010 and IBM SPSS statistics-21 programs - for measuring pollen grain sizes.

A comparative study of coefficient of variation values according to the method of Russian scholar A.S.Mamayev (1972) demonstrates that pollen and pollen body length and width have the lowest level of variation, while air sac length and width are classified as with low variation. Coefficient variation indicators of pollen grain, pollen body and air sac length and width are compared to the study results of Russian scholar E.B.Bajina (2005). It is defined that morphological characteristics of Siberian firs growing in elevated forest regions (body height - 49.8 mcm, body length - 34.5 mcm) and at riverbanks (body height - 52.2 mcm, body length - 37.1 mcm) vary.

In the future, there is a need in the cariological and molecular genetic study of Siberian fir in Mongolia.

Keywords: *Variability, Siberian fir, Abies sibirica, pollen, morphological features, Bugant.*

Introduction. The morphology of conifer forest pollen and their peculiarities in the southern areolas of Siberia is researched in numerous special literature [2, 3, 6, 9, 14, 15, 17]. In Mongolia Siberian fir (*Abies sibirica* Ledeb) is spread in some parts of the north-west of the mountain range Hetiy, from the Tolgoit to Menza river, the feeder of the Shishhet in the province of Hubsgul, in the valleys of the Zholgo river, Zhamec and Busa. Siberian fir that is the least studied of forest generating woody plants of Mongolia from the point of view of its genetic-selective peculiarities covers 0.01% of the wood square of Mongolia. It largely restricts the possibility of rational usage of resource fir wood and does not allow scientific working to select and seed farm of this species. Most often Siberian fir grows mingling with fir tree, cedar and other species. Scarce research of Siberian fir complicates studying polymorphism of this species within its areal. Researching the analytical selection that is its population variability and on the whole intraspecific differentiation is topical and essential for theoretical and practical tasks [5].

Objects and research methods. The morphological variability research of Siberian fir was done in the north-eastern regions of Mongolia, in particular mountain forests of Bugantay and along the river Bugantay.

It was researched the most characteristic forest type: fir forest reedgrass-forbs and fir forest reedgrass-greenmoss which at the bottom of the south-eastern and northern sloping flank (13-15°) of

the mountain on the absolute altitude 1500-1550m in the north-western part of Hetiy. In the planting of this forest type three pilot areas were set. The square of the pilot areas was established so that on each of them there were no fewer than 200 trees that provided rather high accuracy of establishing the assessment features of Siberian fir.

The morphological variability research of peculiarities with account of noted methodological points and conclusions formulated in the works of S. A. Mamaev [7,8] and other authors was done in mature

III-IY(VI-VII age classes) middle-full 0.5(0.6-0.7) planting.

In the limits of the pilot areas for every tree the following estimating values were measured: mean height, diameter at 1.3m, the treetop width in directions from north to south and east to west. By estimated results of the pilot areas we chose the model trees. The seeding research of Siberian fir was done (according to the scale of Kapper V. G) in natural planting and at the fruiting term.

The description of the researched forest was done according to I. N. Tretiakova and other authors [16, 17]. On every area the pollen was collected from 30 trees. In the laboratory the pollen seed size was measured of the fresh collected pollen (in 21-25 days after being collected). The data of the pollen seed size was received on the basis of the following biometrical values: length and height of the pollen seed body and length and height of the air sac. The material was examined on the microscope XSP – 8CA and the program J.MIVNT- Micro-Image Analysis System was used.

During the material processing we used the statistical methods. For every characteristic we calculated: limit values (max, min), arithmetic average (X), error of mean (m). To estimate the variability degree of the quality features we calculated the variability coefficient ($C_v\%$), that gives an objective idea about the amplitude of the characteristics variability [4,5]. The variability values features was established by the scale suggested by S. A. Mamaev [7].

Results and discussion. Fir anthesis in the mountains of the North-western part of Hetiy takes place from the end of May to the second decade of June. Anthesis in 2012-2013 was registered on May, 25-30 and May, 20-26 correspondingly whereas in the highlands of Bugant anthesis took place later (June, 2-4).

The pollen seed of Siberian fir are bogger in comparison with other species Pinaceae. I. N. Tretiakova and other authors [17] noted that «In conditions of lowlands of the Baikal Lake coastline and Easter Sayan the pollen size parameters appeared higher in comparison with the tress growing in conditions of the highlands of Chamar-Daban». According to our research that agree to the data of I. N. Tretiakova and other authors [17], with absolute altitude increase the pollen parameters of Siberian fir become smaller (table1).

Table 1. The pollen size of Siberian fir /mkm/

Body				Air sac			
length	$C_v\%$	height	$C_v\%$	length	$C_v\%$	height	$C_v\%$
Bugant (highlands 1100 m above sea level)							
74.3±0.6	7.8	49.8±0.5	8.4	34.5±0.15	13.7	23.4±1.4	16.9
Bugant (along the river 915 m above sea level)							
77.8±0.8	5.9	52.4±0.7	7.3	37.1±0.8	11.5	24.5±0.7	15.0

Table 2. Comparison of pollen size of Siberian fir /mkm/

Body				Air sac			
length	$C_v\%$	height	$C_v\%$	length	$C_v\%$	height	$C_v\%$
Bugant (highlands 1100 m above sea level)							
74.3±0.6	7.8	49.8±0.5	8.4	34.5±1.5	13.7	23.4±1.4	16.9
Bugant (along the river 915 m above sea level)							
77.8±0.8	5.9	52.4±0.7	7.3	37.1±0.8	11.5	24.5±0.7	15.0
According to the average data, 2002-2003 of Y.V. Bazhin (2005)							
70±1.0	-	76±2.8	-	45±0.9	-	61±0.8	-
According to I.N. Tretiakova and others (2003) Chamar-Daban (highlands)							
70±1.8	12.0	70±1.4	10.0	44±1.3	15.0	59±1.5	14.0

The difference between the pollen size along the river Bugant and highlands of Bugant are statistically reliable with 5%-м significance level (validity criterion $t_{cp} = 3.68 - 4.61 > t_{st} = 2.04$). In rare forest the individual size of the pollen seeds in all conditions greatly varied. Hence, pollen of Siberian fir on the mountain range of Hetiy in Mongolia is longer and the height of the air sac of 68.4 – 71.1% less.

We compared the received size of pollen seed of Siberian fir with mountain range of Sayan area and Chamar-Daban on the Russian territory [1,17] (table 2).

Conclusion. The results of our research prove the conclusions of many authors [2,17], who think that pollen size of Siberian fir become smaller with the altitude increase. The length of the pollen body varies from 5.9 to 7.8%, whereas the height scarcely varies 7.3 – 8.4%. The parameters of the pollen air sac of Siberian fir vary at a higher level than the pollen body size.

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