Morphometric Indicators of Pollen of Some Trees and Shrubs Distributed in the Northeastern Part of the Greater Caucasus (Azerbaijan) in ex situ Conditions

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Abstract

In the conducted research, in ex situ condition were studied the main characteristics of the pollen of trees and shrubs distributed in the northeastern part of the Greater Caucasus (Azerbaijan). During the research were analyzed the morphology and morphometric measurements of pollen of 18 species included to the 13 genera and 10 families: the length of the polar and equatorial diameter, the length of the furrow, the width of the mesocolpium, the diameter of the apocolpium. The studied species were distinguished by the fact that the pollen grains are spherical, oval, ellipsoidal, triangular-spherical, 1-3-4 furrowed. The pollen surface was smooth in most species, but bumpy only in Lonicera xylosteum. According to the morphometric size of pollen grains, the species are small (polar size 6.7-6.9 mkm, equatorial size 6.6-7.9), large (polar size 43.9-72.9 mkm, equatorial size 42.2-71 ,97 mkm) and divided into 3 groups with medium size. Among the studied species, the smallest pollen grains were observed in Cotoneaster melanocarpus (Rosaceae), and the largest pollen grains were observed in Lonicera caprifolium (Caprifoliaceae). The fact that the pollen of each species has a different sculpture, the difference in its morphometric dimensions, the taxonomic composition of the species was related to its individual biological characteristics. The viability of the pollen of the studied species was also determined. Pollen viability in the studied species varied between 51-93%. This is an indicator of their pollination and fertilization ability, as well as their high productivity.

Keywords: Pollen grains, polar, equatorial, mesocolpium, apocolpium, fertility
Introduction

Pollens play an important role in the formation of sowing qualities and hereditary characteristics of tree and shrub plants. From the last century to the present, the main characteristics of plant pollen have been reflected in the scientific works of many researchers around the world[1, 5, 7-8, 10-11, 14, 16].

In the literature, information about the pollen of representatives belonging to the families Caprifoliaceae (Lonicera L.) and Fagaceae (Quercus L.) is more common. By many researchers, the morphology of the pollen of the species belonging to the Lonicera L. genus (Caprifoliaceae) were studied using a light microscope, and given their description, pictures. The research conducted on allowed to determine that this genus is homogeneous according to its polymorphology[4, 6]. When studying the pollen of East-Asian representatives of Quercus L. genus (Fagaceae), the sculptural elements of the sporoderm were described, systematized and the main types of sculpturing were determined [9]. When studying the pollen grains of species belonging to the genus of Salix L. cinerea (Salicaceae) were revealed their morphological diversity and the specificity of the quantitative and qualitative indicators of each species, and determined that the signs of pollen grains were constant for the samples distributed in different parts of the area [13].

The main characteristics of the pollen of tree and shrub plants that spread naturally in the north-eastern part of the Greater Caucasus (Azerbaijan) in ex situ (Absheron Peninsula) conditions have not been sufficiently studied. Taking this into account, has been studied the morphology and morphometric measurements of the pollen grains of the studied species in ex situ (Absheron) conditions.

Material and Methods

As research material were used 18 species (Acer campestre L., Carpinus caucasica Grossh., C.orientalis Mill., Cornus mas L., Cotoneaster melanocarpus Fisch. et Blytt, C.multiflorus Bunge, Fagus orientalis Lipsky, Lonicera caprifolium L., L.xylostemum L., Pterocarya pterocarpa (Michx) Kunth ex I.Ilyinsk, Pyracantha coccinea (L.) M.Roem., Salix caprea L., Sorbus torminalis (L.) Grantz, Tamarix ramosissima Ledeb, Tilia begonifolia Stev., T.cordata Mill., Viburnum lantana, V.opulus L.) belonging to the 13 genera and 10 families. The research was carried out in ex situ conditions.

Morphological and morphometric characteristics of pollen were studied to the method of A.N. Burmistrav [2], I.N. Golubinski [3], L.T. Pausheva [12] and N.S. Samigulinamin [15]. Studies were performed using a Humo Scope microscope, and photographs were taken with an AM 7023 Dino-Eye microscope camera.

Results and Their Discussion

In the conducted research were determined the morphology and morpoph-
metric measurements of pollen grains of tree and shrub plants studied in Absheron conditions. When the preparations were examined under a microscope, it was determined that fertile pollen is stained pink with acetocarmine. Sterile pollen are not painted, they remain yellowish in color. The studied species differed according to the forms of the pollen grains being spherical, oval, wide elliptical, triangular-spherical, 1-3-4 furrowed. The color of the pollen is light yellow, and it is covered with an exine layer. Due to this layer, pollen maintains its durability and viability against adverse environmental conditions. In most species, the surface of the pollen is smooth, but in some species it is bumpy and uneven (*Lonicera xylosteum*). Polar, equatorial diameter and furrow length of pollen grains of each species, mesocolpium width, apocolpium diameter, pollen viability were studied and obtained results were recorded (table 1, Figure 1).

Based on the obtained results, it was determined that the size of the pollen is varies in different species. Thus, is varied between: the polar size 6.7-72.9 mkm, the equatorial size 6.60-71.97 mkm, the length of the furrow 6.20-52.9 mkm, the width of the mesocolpium 4.10-35.9, the diameter of the apocolpium is 2.10-48.2 mkm.

Pollen grains of the studied species were divided into 3 groups, small, medium and large according to their morphometric size. The species *Cotoneaster melanocarpus* belonging to the genus *Cotoneaster* (*Rosaceae*) is distinguished by the very small size of the pollen grains. At the same time, the length of the pollen furrow (6.20-6.24 mkm), the width of the mesocolpium (4.10-5.60 mkm), and the diameter of the apocolpium (2.10-4.30 mkm) were smaller in the species *Cotoneaster melanocarpus*.

**Table 1.** Morphometric indicators of species in ex situ conditions (mkm) and vitality

<table>
<thead>
<tr>
<th>№</th>
<th>Species</th>
<th>Polar size</th>
<th>Equatorial size</th>
<th>The length of the furrow</th>
<th>Width of mesocolpium</th>
<th>Apocolpi-um diameter</th>
<th>Pollen fertility, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Acer campestre</em></td>
<td>34.5-41.9</td>
<td>29.1-43.4</td>
<td>27.4-34.5</td>
<td>21.8-22.9</td>
<td>10.7-14.6</td>
<td>90</td>
</tr>
<tr>
<td>2.</td>
<td><em>Carpinus caucasica</em></td>
<td>30.4-35.5</td>
<td>28.7-34.7</td>
<td>23.1-27.2</td>
<td>16.1-18.97</td>
<td>8.30-11.1</td>
<td>86</td>
</tr>
<tr>
<td>4.</td>
<td><em>Cornus mas</em></td>
<td>19.5-34.6</td>
<td>18.96-30.2</td>
<td>16.9-27.4</td>
<td>10.88-20.3</td>
<td>7.88-13.3</td>
<td>80</td>
</tr>
<tr>
<td>5.</td>
<td><em>Cotoneaster melanocarpus</em></td>
<td>6.70-6.9</td>
<td>6.60-7.90</td>
<td>6.20-6.24</td>
<td>4.10-5.60</td>
<td>2.10-4.30</td>
<td>53</td>
</tr>
<tr>
<td>7.</td>
<td><em>Fagus orientalis</em></td>
<td>34.4-45.1</td>
<td>37.6-44.8</td>
<td>27.8-34.5</td>
<td>18.2-25.1</td>
<td>9.60-15.3</td>
<td>82</td>
</tr>
<tr>
<td>8.</td>
<td><em>Lonicera caprifolium</em></td>
<td>43.9-72.9</td>
<td>42.2-71.97</td>
<td>29.1-52.9</td>
<td>22.9-35.9</td>
<td>25.9-48.2</td>
<td>61</td>
</tr>
<tr>
<td>9.</td>
<td><em>L.xylosteum</em></td>
<td>47.7-56.3</td>
<td>46.7-50.5</td>
<td>41.7-46.98</td>
<td>29.2-34.9</td>
<td>25.5-29.4</td>
<td>91</td>
</tr>
<tr>
<td>10.</td>
<td><em>Pterocarya pterocarpa</em></td>
<td>27.97-32.4</td>
<td>26.1-27.6</td>
<td>21.4-24.8</td>
<td>16.2-17.3</td>
<td>5.80-7.70</td>
<td>57</td>
</tr>
<tr>
<td>11.</td>
<td><em>Pyracantha coccinea</em></td>
<td>17.3-21.6</td>
<td>17.5-20.7</td>
<td>16.6-19.2</td>
<td>11.1-12.3</td>
<td>5.80-7.60</td>
<td>72</td>
</tr>
<tr>
<td>12.</td>
<td><em>Salix caprea</em></td>
<td>15.6-16.3</td>
<td>15.3-16.7</td>
<td>12.0-14.8</td>
<td>8.50-10.1</td>
<td>4.20-6.60</td>
<td>93</td>
</tr>
<tr>
<td>13.</td>
<td><em>Sorbus torminalis</em></td>
<td>22.9-34.4</td>
<td>22.5-37.0</td>
<td>18.6-27.4</td>
<td>12.8-15.95</td>
<td>5.10-8.60</td>
<td>65</td>
</tr>
<tr>
<td>15.</td>
<td><em>Tilia begonifolia</em></td>
<td>31.7-35.4</td>
<td>31.8-33.6</td>
<td>23.7-31.6</td>
<td>15.3-18.4</td>
<td>13.6-15.8</td>
<td>81</td>
</tr>
<tr>
<td>16.</td>
<td><em>Tilia cordata</em></td>
<td>30.3-33.1</td>
<td>31.4-32.9</td>
<td>27.9-31.1</td>
<td>20.4-21.4</td>
<td>16.2-21.3</td>
<td>51</td>
</tr>
<tr>
<td>17.</td>
<td><em>Viburnum lantana</em></td>
<td>24.4-31.9</td>
<td>23.8-35.7</td>
<td>21.4-25.7</td>
<td>13.1-13.9</td>
<td>8.50-11.1</td>
<td>66</td>
</tr>
</tbody>
</table>
Figure 1. Microscopic view of the pollen of the studied species
1-Acer campestre, 2-Carpinus caucasica, 3-Carpinus orientalis, 4-Cornus mas,
5-Cotoneaster melanocarpus, 6-Cotoneaster multiflorus, 7-Fagus orientalis,
8-Lonicera caprifolium, 9-Lonicera xylosteum, 10-Pterocarya pterocarpa, 11-Pyracantha coccinea, 12-Salix caprea, 13-Sorbus terminalis, 14-Tamarix ramosissima, 15-Tilia begonifolia, 16-Tilia cordata, 17-Viburnum lantana, 18-Viburnum opulus.

Large pollen grains were observed in Lonicera caprifolium (polar size 43.9-72.9 mkm, equatorial size 42.2-71.97 mkm) and L. xylosteum (polar size 47.7-56.3 mkm, equatorial size 46.7-50.5 mkm) species belonging to Lonicera genus (Caprifoliaceae). In these species, furrow length (29.1-52.9 mkm 41.7-46.98 mkm), mesocolpium width (22.9-35.9 mkm; 29.2-34.9 mkm), apocolpium diameter (25.9-48.2 mkm; 25.5-29.4 mkm) was high.

Pollen grains of the other studied species were of medium size. In these species, the smallest polar size was 13.5 mkm, and the largest equatorial size was 43.4 mkm. The furrow length varies between 6.2 to 34.5 mkm. The width of the mesocolpium was the lowest-5.90-7.80 mkm, the highest 21.8-22.9 mkm, the diameter of the apocolpium was the lowest 4.20-6.60 mkm, the highest 16.2-21.3 mkm.

During the research, the viability of the pollen of the species was also determined. Being one of the important indicators for introduced plants, it is one of the main factors showing how they adapt to new soil-climate conditions.

According to the research results, it can be said that the viability of the pollen of species introduced to Absheron is high (51-93%). Acer campestre, Carpinus caucasica, Carpinus orientalis, Cornus mas, Fagus orientalis, Lonicera caprifolium, Lonicera xylosteum, Salix caprea, Tilia begonifolia, Cotoneaster multiflorus, Pyracantha coccinea, Sorbus terminalis, Viburnum lantana, Viburnum opulus species had the highest viability (61-93%). This shows that their ability to pollinate and fertilize, as well as their productivity, is high. Other species (Cotoneaster melanocarpus, Pterocarya pterocarpa, Tamarix ramosissima, Tilia cordata) had relatively low (42-57%) viability. The pollen of the species retained its viability despite being kept in a refrigerator for a long time under special conditions (at a temperature of 2-50 C). However, depending on weather and storage conditions, the viability of pollen can change.

Results

1. According to the results of the general microscopic analysis of the pollen of plants distributed in the northeastern part of the Greater Caucasus in ex situ conditions, species are divided into 3 groups according to the morphometric indicators of their pollen: 1. Species(Cotoneaster melanocarpus, Tamarix ramosissima) with small pollen. 2. Species(Lonicera caprifolium, L. xylosteum) with large pollen. 3. Species(other studied species) with medium size of pollen.

2. The small polar size of the pollen of the studied species varied from 6.7 mkm to 47.7 mkm, and the large polar size varied from 6.9 mkm to 72.9 mkm. The large equatorial size of pollen grains was between 7.9 mkm and 71.97 mkm, and the small equatorial size was between 6.6 mkm and 46.7 mkm.
3. According to the research results, the viability of the pollen of the species introduced to Absheron was high, so that the viability was higher than 50% in most of the species. This is an indicator of their high pollination and fertilization ability and vitality.

References


Received: December 5, 2023; Published: December 20, 2023