Comparative study of pollen morphology and fertility in *Pyrus* L. species under *in situ* and *ex situ* conditions in Greater Caucasus, Azerbaijan

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Abstract. A number of negative changes are observed in the pollen of the vast majority of plants distributed in polluted areas: morphological immaturity or the observation of sterile pollen grains during pollination, a quantitative decrease in the total productivity of pollen, and a decrease in the germination capacity of the pollen tube.For this reason, pollen analysis is considered one of the most reliable and effective methods in environmental quality assessment as the main component of phytoindication. Light microscopy (LM) has been used to study the morphology and fertility characteristics of pollen grains in five species of Rosaceae Juss. (Pyrus L.) in detail. The study used pollen that was collected in the Republic of Azerbaijan. In this research were used Harley methods. The main purpose of the work was the comparative study of the quality and morphological characteristics of the pollen of Pyrus L. species in natural and cultural conditions.It were determined that underex situ conditions, it was found that the pollen productivity coefficient was the highest in Pyrus vsevolodii (86%), and the lowest in Pyrus georgica (72%),but under in situ conditions, the highest P.vsevolodii (89%) and the lowest P.georgica (72%) species were found in pollen.

1 Introduction

About 60 species of the genus *Pyrus* L. are known in the northern hemisphere of Eurasia. Thus, 22 wild species and 2 cultivated species can be noted in the modern flora of Azerbaijan. Pear species are distributed in Azerbaijan mainly in dry areas in the upper mountain belt, in forests, and sometimes on rocks. Most species are rare, and some species have a wide range [2].

Numerous species of *Pyrus communis* L. and *Malus domestica* Borkh. are intricate hybrids, and the classification of wild plants is made more difficult by the prevalence of interspecific hybrids. Thus, it would be very interesting to be able to identify the morphological characteristics of apple and pear pollen grains using contemporary equipment by considering their microstructure in addition to their external characteristics [5, 12].The main goal of research has been to ascertain whether, in a narrow or broad sense, observed variation in pollen characteristics within populations is heritable. This emphasis is warranted

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considering that changes in pollen characteristics cannot have evolutionary significance unless there is some additive genetic variation.

The findings presented here suggest that most of the variation in pollen characteristics that has been observed is not genetically driven; however, this does not rule out the possibility that pollen characteristics have a heritable component [9].Thus, the current study was planned and recorded with the following goals in mind: first, to advance our understanding of the palynology of multiple populations within the R. sericea complex; second, to investigate the intricate morphological characteristics of pollen through the use of SEM; and third, to investigate whether palynological data can be used as supporting evidence for the taxonomy of this complex species[4].The statistical analysis's findings are not entirely clear in terms of the distribution of the 67 individuals (oaks) among the six groups to which they were allocated, as well as the locations of their collection. The first, sizable group included the majority of those analyzed [14]. As far as we know, in flowering plants, microsporocidal male cells produce pollen. Microsporogenesis is the term for the process of spore formation A sporoderm with two layers (exine and intine) covers the pollen grain from the exterior. The thin portion of the exine, or outer layer, facilitates the exit of one or more porous pollen tubes. Pectin and cellulose combine to form intin, which is a thin, flexible substance that is easily distributed. Pollen's structure has begun to show indications of adaptation in order to defend itself against harmful environmental influences.

There are some features of *Pyrus* L. genus species as leaf epidermis,new records for Iran area and pollen morphology [15-17].

2 Materıals and Methods

In the study, pollen from 5 *Pyrus* L. species in the northeastern part of the Greater Caucasus were collected under*ex situ* and *in situ* conditions.*Ex situ* condition was carried out in Central Botanical Garden, *in situ* area was northern-eastern part of Great Caucasus, Azerabiajan. Pollen morphology and viability were studied using a Humo Scope microscope (LM) , photographs were taken with an AM 7023 Dino-Eye microscope camera. Harley's methods were used to study pollen morphology and fertility in our research work [8].

In the mathematical statistical calculation of the experimental results, generally accepted methods were used. The analysis of the research was carried out in the laboratory of the Central Botanical Academy of Sciences. The objects of study are 5 species of the genus *Pyrus* L. in the northeast of the Greater Caucasus: *Pyrus communis* L., *Pyrus caucasica* Fed., *Pyrus georgica* Kuth., *Pyrus vsevolodii* Heideman, *Pyrus salicifolia* Pall.

3 Results and Discussıon

Table 1 shows that the morphometric indicators of pollen from the different studied pear species vary in both polar and equatorial sizes.

Table 1. Morphometric parameters of pollens of species *Pyrus* L. genus under *ex situ* condition

No.	Species	Morphometric parameters (μm)		Pollen vitality
		equatorial	polar	%
1	*Pyrus communis* L.	21,98–40,09	20.40-36.45	73
2	*Pyrus caucasica* Fed.	27,47–41,15	24,49–36,29	82
3	*Pyrus georgica* Kuth.	32,17–39,80	29,10–37,46	72
4	*Pyrus vsevolodii* Heideman	34,25–41,53	33,85–39,69	86
5	*Pyrus salicifolia* Pall.	27,99–39,80	25,48–35,92	78

Figю 1 (a, b) shows the morphometric measurements of pollen under *in situ* and *ex situ* conditions for the studied species as well as their overall view under LM. The primary features of pollen may vary amongst populations within the same species based on morphometric indicators.

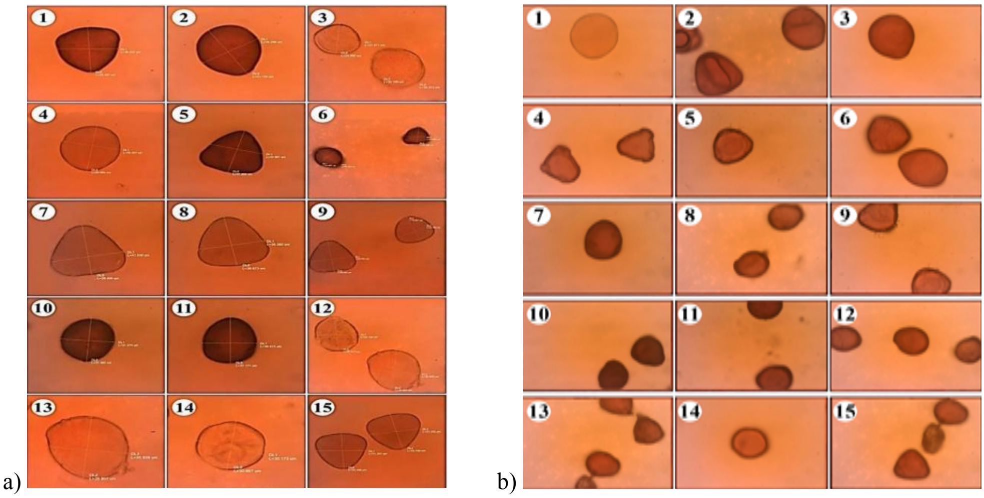

Fig. 1 morphometric measurements of pollen a) *Ex situ*, b) *In situ* morphometric parameters of pollen of *Pyrus* L. species: 1-3 – *Pyrus caucasica;* 4-6 – *P. communis;* 7-9 – *P. vsevolodii;* 10-12 – *P. georgica*; 13-15 – *P. salicifolia.*

The conducted analyzes showed that the fertility of the pollen of the studied species in *ex situ* conditions varies between 72-86% depending on the species [1].

Fig. 2 (a, b) presents data on indicators of pollen vitality of species belonging to *Pyrus* L. under *ex situ* and *in situ* conditions.

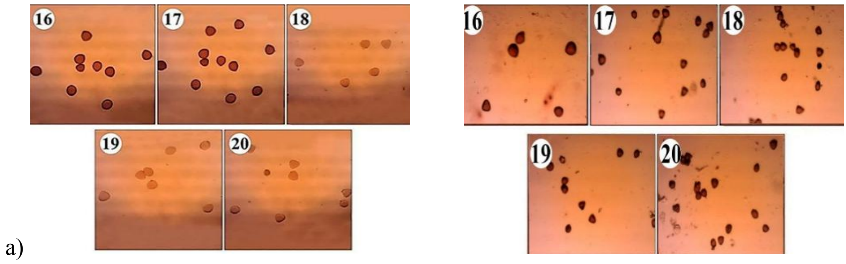

Fig. 2. *Ex situ* b) *In situ* indicators of pollen viability of species belonging to the genus *Pyrus* L.: 16 – *Pyrus vsevolodii*; 17 – *P.caucasica*; 18 – *P. georgica;* 19 – *P. communis;* 20- *P. salicifolia*

Table 2 shows variations between two different indices.

Table 2. **Morphometric parameters of pollens of species *Pyrus* L. genus under *in situ* condition**

No.	**Species**	**Morphometric indicators (µm)**		**Pollen vitality**
		equatorial	**polar**	**%**
1	*Pyrus communis* L.	24,12–44,11	27,12–39,45	76
2	*Pyrus caucasica* Fed.	28,32–41,52	29,25–39,67	84
3	*Pyrus georgica* Kuth.	39,15–42,56	34,17–41,12	74
4	*Pyrus vsevolodii* Heideman	37,23–47,11	35,24–43,65	89
5	*Pyrus salicifolia* Pall.	29,34–43,45	28,45–38,57	81

Based on the study characteristics, it turned out to be impossible to identify individual species of Sansevieria, but only their groups. The species belonging to these groups did not always come from the same sections. The morphological characteristics of pollen grains described in this paper can be used for comparison with species of the closely related genus Dracaena, so these studies need to be continued [11]. This pollen type is 3-sulculate, echinolophate, oblate-spheroidal, with 29 lacunae, including the polar one, but without the equatorial lacunae. Chrysolaena is considered stenopaline due to the fact that the pollen type is similar in most species. Nevertheless, the variability in the sizes of pollen grains made it possible to distinguish three groups of taxa: small, medium and large, respectively. Pollen morphology is a useful taxonomic marker in addition to other morphological and molecular characters that define the genus and environmental condition [7].

Conclusıon

After conducting a comprehensive microscopic analysis and conducting mathematical computations, it was determined that there is not a significant difference between the morphometric indicators of the two species under study—equatorial and polar. A higher equatorial index than *ex situ* conditions was observed in *Pyrus vsevolodii* species (34.25-41.53 µm) and the lowest*Pyrus salicifolia* pollen (27.99-39.80 µm). In situ conditions, the highest equatorial index was observed in *P. georgica* (39.15–42.56 µm), and the lowest in *P. caucasica* pollen (28.32–41.52 µm). From *ex situ* conditions, it was determined that the highest polar index was found in *Pyrus vsevolodii* species (33.35-39.69 µm), and the lowest in the pollen of *Pyrus communis* species (20.40-36.45 µm). *In situ* conditions, *P.vsevolodii* (37.24–43.65 µm) and the lowest*P.salicifolia* pollen (28.45–38.57 µm) were observed. In *ex situ* conditions, it was found that the pollen productivity coefficient was the highest in *Pyrus vsevolodii* (86%), and the lowest in *Pyrus georgica* (72%). *In situ* conditions, the highest *P.vsevolodii* (89%) and the lowest *P.georgica* (72%) species were found in pollen. In *ex situ* conditions, it was found that the pollen productivity coefficient was the highest in *Pyrus vsevolodii* (86%), and the lowest in *Pyrus georgica* (72%). To summarize, we can say that a number of negative cases were observed in the pollen of plants that are common in areas that are not ecologically clean. These cases include the formation of morphologically immature pollen or sterile pollen grains. As a result, the general quantity and quality indicators of pollen have decreased.

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