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**A. M. Hayrapetyan, H. H. Sonyan, A. H. Muradyan**

# Pollen of Trees and Shrubs of Armenia (Angiospermae. XIII. *Rosaceae.* Genus *Sorbus*)

(Submitted by corresponding member of NAS RA Zh. H. Vardanyan 27/I 2022)

**Keywords:** *pollen morphology, Sorbus L., LM, SEM.*

**Introduction.** The polymorphous genus *Sorbus* l. includes 100-250 deciduous trees or shrubs that are widespread mainly in temperate areas in the Northen Hemisphere – Europe, Asia and North America. In the Caucasus and Turkey ca. 35 species occur, the total number of the species in Armenia is 10-15 [1-7].

Palynological investigations of the representatives of the genus *Sorbus* using light microscopy (LM) and scanning electron microscopy (SEM) were carried out by Erdtman et al. [8], Praglowski [9], Reitsma [10], Gabrielyan [2, 11, 12], Kuprianova, Alyoshina [13], Eide [14], Valdes et al. [15], Bednorz et al. [16], Tokarev [17], Bednorz et al. [18], Perveen, Qaiser [19] general description of the pollen morphology of the genus *Sorbus* in the Armenian flora on the level of light microscopy was presented in Volume III of the Flora of Armenia [20].

Our study provides a detailed analysis of the pollen morphology of 10 species of the genus *Sorbus* of Armenia on the level of light microscopy and scanning electron microscopy.

**Material and Methods.** The material studied was obtained from the herbarium of the Institute of Botany after A. Takhtajyan, NAS Republic of Armenia, Yerevan (ERE).

The descriptions of the pollen grains with the help of the light microscope are based on the grains stained with basic fuchsine [21] and also on the simplified acetolysis method [22]. Pollen grains for the scanning electron microscopes (Jeol, JSM-35) were vacuum sputter-coated with gold and investigated in the laboratory of electronic microscopy of Botanical Institute, St.- Petersburg, Russia.

The palynological terminology used in our study mainly follows Erdtman

[23], Kuprianova and Alyoshina [24, 25], Punt et al. [26] and Hesse et al. [27].

Ten pollen grains were examined and measured for each investigated specimen.

**Specimens examined** (species names are given mainly in accordance with The Plant List [28]): ***Sorbus armeniaca*** Hedl. (ERE, 92160); ***S. aucuparia*** L. (ERE, 39449; ERE, 71606); ***S. caucasica*** Zinserl. (ERE, 39447; ERE, 92155 ERE, 193165); ***S. graeca*** (Spach) Lodd. ex Schauer (= *S. cretica* (Lindl.) Fritsch (ERE, 88202; ERE, 91100; ERE, 116007); ***S. hajastana*** Gabrieljan: (ERE, 61713; ERE, 98445); ***S. persica*** Hedl. (ERE, 75790); ***S.* x *roopiana*** Bordz. (ERE, 64949); ***S. subfusca*** (Ledeb.) Boiss. (ERE, 100370); ***S. takhtajanii*** Gabrieljan (ERE, 90645); ***S. torminalis*** (L.) Crantz (ERE, 71608).

**Results and Discussion.** Pollen grains of the investigated species of the genus *Sorbus* L. are 3-zonocolp-porate (Plate 1, phototables I-III), or 3-zonocolp-pore-orate, sometimes 3(4)-zonocolp-pore-orate (*S. hajastana* Gabrieljan (phototable II, 13), *S.* x *roopiana* Bordz., *S. takhtajanii* Gabrieljan), rarely 6-aperturate (4-zonocolp-poroidate and 1+1-colpate, colpi situated on both

**Plate 1**

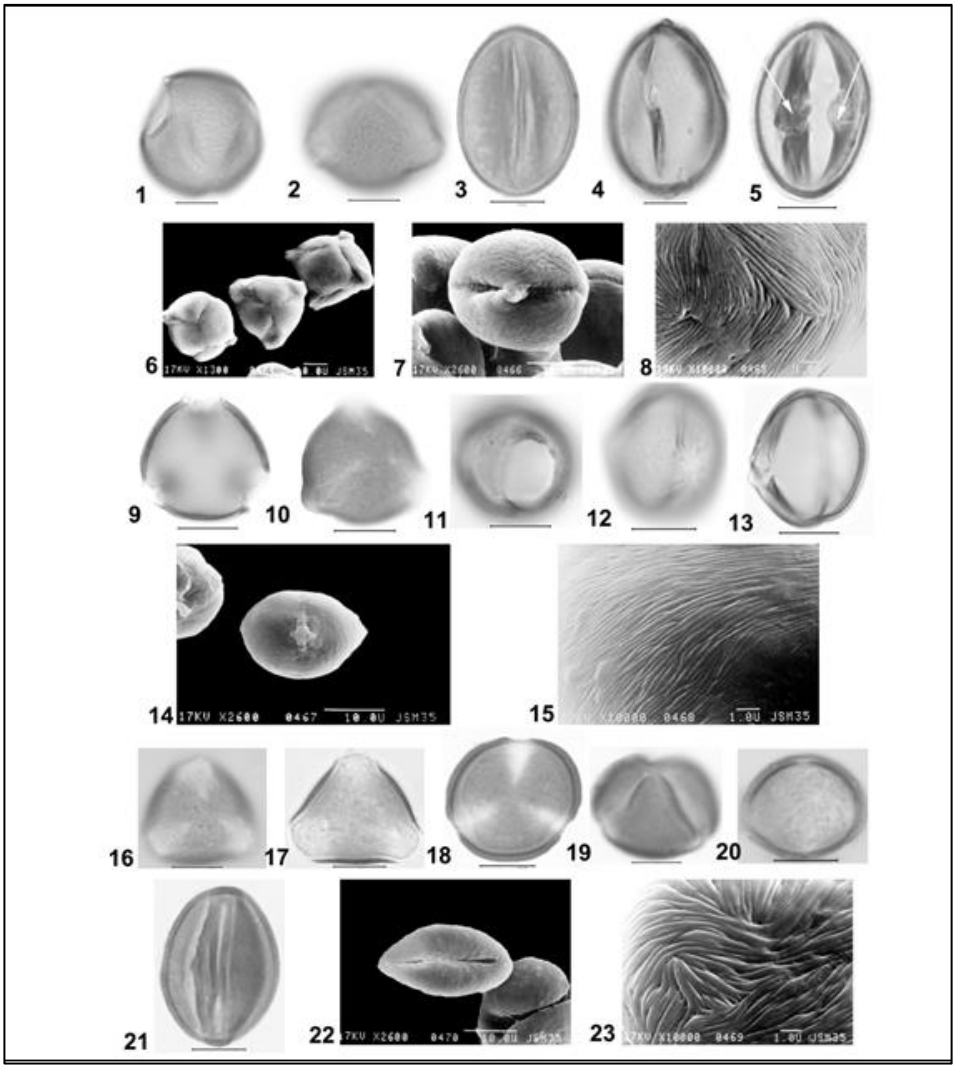
**Palynological characteristics of some species of the genus *Sorbus* L.**

| Species | Pollen grain size (P x E*) (μm) | Colpus | | Exine ornamentation | | Pollen sterility (Gabrielian, 1978) (%) |
|---|---|---|---|---|---|---|
| | | apocolpium diameter (μm) | mesocolpium width (μm) | LM | SEM | |
| *Sorbus armeniaca* Hedl. | 28.5-35.7 x 20.1-28.6 | 3.5-4.7 | 12.3-16.2 | striate, striae short | rarely perforate-striate, striae often branched and curved | 45-70 |
| *S. aucuparia* L. | 14.7-23.3 x 17.9-18.5 | 4.5-5.4 | 8.3-12.5 | finely striate | finely striate | 1-7 |
| *S. caucasica* Zinserl. | 18/5-28.9 x 14.8-23.5 | 4.5-5.1 | 10.5-12.9 | granulate | perforate-finely striate, striae short, often curved | 45-70 |
| *S. graeca* (Spach) Lodd. ex Schauer | 23.1-27.8 x 20.5-22.7 | 4.2-5.3 | 18.2-23.5 | granulate | finely striate, striae short, sometimes | – |

* P – polar axis, E – equatorial diameter.

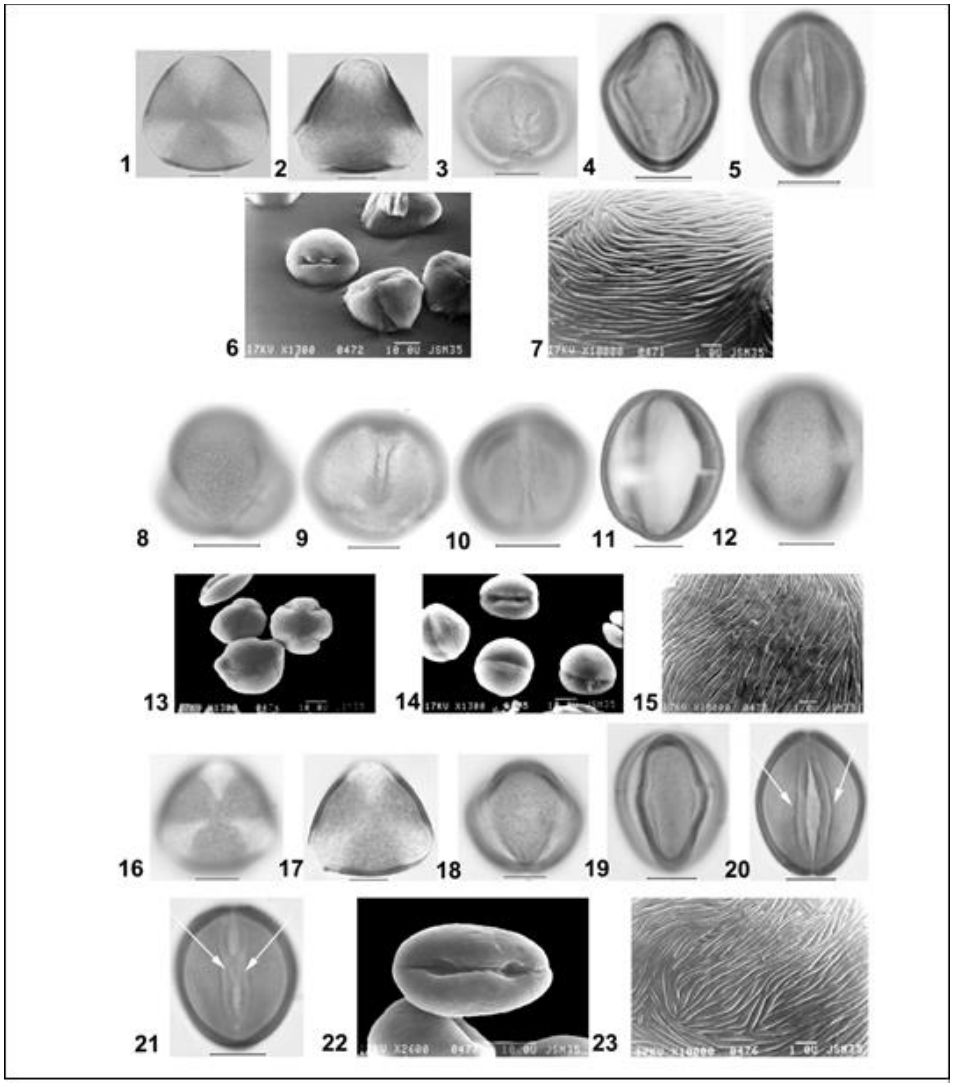
| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | curved | |
| *S. hajastana* Gabrieljan | 22.2-28.5 x 22.1-25.6 | 3.6-4.8 | 14.9-18.5 | finely striate | perforate-finely striate | up to 35 |
| *S. persica* Hedl. | 25.9-32.5 x 16.8-23.8 | 3.5-4.6 | 11.8-12.8 | granulate | rarely perforate-striate, striae often branched and curved | 45-70 |
| *S.* x *roopiana* Bordz. | 22.1-25.6 x 18.2-22.4 | 4.1-5.1 | 18.1-18.5 | finely striate | – | up to 35 |
| *S. subfusca* (Ledeb.) Boiss. | 25.4-27.9 x 15.5-23.5 | 3.5-4.8 | 12.9-15.8 | finely striate | perforate-striate, striae often branched and curved | 5-10 |
| *S. takhtajanii* Gabrieljan | 17.5-22.9 x 16.1-23.1 | 4.2-5.0 | 14.1-15.6 | finely striate | – | 45-70 |
| *S. torminalis* (L.) Crantz | 17.1-26.2 x 14.5-22.1 | 3.8-4.8 | 12.9-16.1 | finely reticulate | – | 2-4 |

poles) (*S. armeniaca* Hedl.), from oblong to oblate, outline in polar view rounded-3(4)-angular or rounded 3(4)-lobed; polar axis (P) 14.7-35.7 μm, equatorial diameter (E)14.5-28.6 μm. Colpi geniculate, from wide to narrow, sometimes almost slit-like, long, usually with evenly thickened edges and with rounded or pointed, sometimes with anastomosing ends, i. e. synaperturate (*S. takhtajanii*); colpus membrane ornamentation from almost smooth to densely granular; apocolpium diameter 3.5-5.4 μm, mesocolpium width 8.3-23.5 μm. Due to the presence of the geniculum or the convergence of the colpi edges in the equator, pores and ora (if present) often weakly expressed; pores spheroidal, sometimes oblong, with uneven edges; ora small, with pointed ends. Exine 1.4-1.5 μm, columellae thin, separate, with rounded ends. Exine ornamentation granulate, reticulate or striate (LM), exine ornamentation finely striate or perforate-striate, striae often branched and curved (SEM).



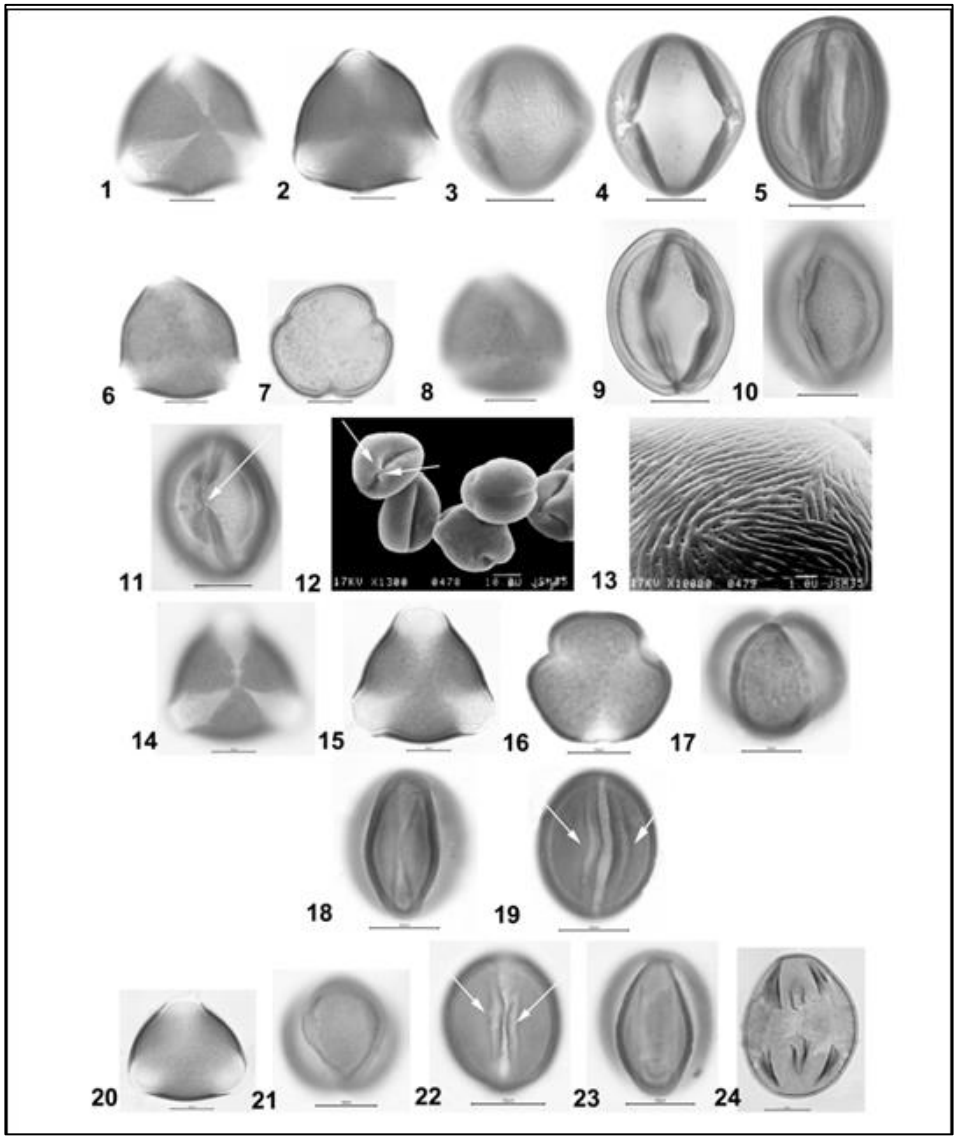
**Phototable I. Pollen grains of some species of the genus *Sorbus* L.**

1-8 – *S. armeniaca* Hedl.: 1 – pollen grain from semipolar view, 2-5 – pollen grains from equatorial view (5 – colpi with genuculum, marked by arrows) (LM), 6 – 3- and 6 (4+1+1)-aperturate pollen grains from polar view, 7 – pollen grain from equatorial view (aperture), 8 – exine ornamentation (SEM); 9-15 – *S. aucuparia* L.: 9-10 – pollen grains from polar view, 11-13 – pollen grains from equatorial view (LM), 14 – pollen grain from equatorial view (aperture), 15 – exine ornamentation (SEM); 16-23 – *S. caucasica* Zinserl.: 16-19 – pollen grains from polar and semipolar (19) view, 20-21 – pollen grains from equatorial view (LM), 22 – pollen grain from equatorial view, 23 – exine ornamentation (SEM) (scale bar: 1-5, 9-13, 16-21 – 10 μm).



**Phototable II. Pollen grains of some species of the genus Sorbus L.**

1-7 – *S. cretica* (Lindl.) Fritsch & Rech.: 1-2 – pollen grains from polar view, 3-5 – pollen grains from equatorial view (LM), 6 – pollen grains from equatorial and semipolar view, 7 – exine ornamentation (SEM); 8-15 – *S. hajastana* Gabrieljan: 8-9 – pollen grains from semipolar view, 10-12 – pollen grains from equatorial view (12 – exine ornamentation), 13 – 3- and 4- aperturate pollen grains from polar and semipolar view, 14 – pollen grains from equatorial view (apertures), 15 – exine ornamentation (SEM); 16-23 – *S. persica* Hedl.: 16-19 – pollen grains from polar and semipolar (18) view, 19-21 – pollen grains from equatorial view (20 – thickening of colpi edges, 21-colpus with geniculum, marked by arrows), 22 – pollen grain from equatorial view (aperture), 23 – exine ornamentation (SEM) (scale bar: 1-5, 8-12, 16-22 – 10 μm).




**Phototable III. Pollen grains of some species of the genus *Sorbus* L.**

1-5 – *S.* x *roopiana* Bordz.: 1-2 – pollen grains from polar view, 3-5 – pollen grains from equatorial view (LM), 6-13 – *S. subfusca* (Ledeb.) Boiss.: 6-8 – pollen grains from polar view, 9-11 – pollen grains from equatorial view (11 – colpus with geniculum, marked by arrow) (LM), 12 – pollen grains from semipolar and equatorial view (colpus with geniculum, marked by arrows), 13 – exine ornamentation (SEM); 14-19 – *S. takhtajanii* Gabrieljan: 14-16 – pollen grains from polar view, 17-19 – pollen grains from equatorial view (19 – thickening of colpi edges, marked by arrows) (LM); 20-24 – *S. torminalis* (L.) Crantz: 20 – pollen grain from polar view, 21-24 – pollen grains from semiequatorial (21) and equatorial view (22 – aperture, thickening of colpi edges, marked by arrows) (LM) (scale bar: 1-11, 14-24 – 10 μm).

Gabrielian [2] noted, that some of the *Sorbus* species, particular *S. armeniaca* Hedl., *S. caucasica* Zinserl., *S. persica* Hedl., *S. takhtajanii* Gabrieljan have a high percentage of sterile pollen grains (Plate 1), so according to the author, these species are either hybrid or polyploid ones. The presence of abnormal pollen grains in these species is also confirmed by our investigations.

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Institute of Botany after A. Takhtajyan of NAS RA
e-mail: alla.hayrapetyan.63@gmail.com

**A. M. Hayrapetyan, H. H. Sonyan, A. H. Muradyan**

**Pollen of Trees and Shrubs of Armenia (Angiospermae. XIII. *Rosaceae.* Genus *Sorbus*)**

Pollen morphology of 10 species of Armenian trees and shrubs from the genus *Sorbus* L. (family *Rosaceae* Juss.) was studied using light microscopy and scanning electron microscopy.

**Ա. Մ. Հայրապետյան, Հ. Հ. Սոնյան, Ա. Հ. Մուրադյան**

**Հայաստանի ծառերի և թփերի ներկայացուցիչների ծաղկափոշու ուսումնասիրությունը (Angiospermae. XIII. *Rosaceae. Sorbus* ցեղը)**

Լուսային և սկաներային էլեկտրոնային մանրադիտակների օգնությամբ ուսումնասիրվել է Հայաստանի դենդրոֆլորայի *Sorbus* L. ցեղին (*Rosaceae* Juss. ընտ.) պատկանող 10 տեսակների ծաղկափոշու մորֆոլոգիան:

**А. М. Айрапетян, А. О. Сонян, А. Г. Мурадян**

**Морфология пыльцы деревьев и кустарников Армении (Angiospermae. XIII. *Rosaceae.* Род *Sorbus*)**

С помощью светового и сканирующего электронного микроскопов изучена палиноморфология 10 видов деревьев и кустарников Армении из рода *Sorbus* L. (сем. *Rosaceae* Juss.).

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