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POLLEN OF TREES AND SHRUBS OF ARMENIA (ANGIOSPERMAE. X. *Rosaceae*. Genera *Crataegus, Cydonia*, *Malus, Mespilus*, *Padus, Persica, Prunus*)

Pollen morphology of 21 species of Armenian trees and shrubs from the genera *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Mespilus* L., *Padus* Mill., *Persica* Mill., *Prunus* L. (family *Rosaceae* Juss.) was studied using light microscopy (LM) and scanning electron microscopy (SEM).

Pollen morphology, trees, shrubs, LM, SEM

Հայրապետյան Ա. Մ., Մուրադյան Ա. Հ. Հայաստանի ծառերի և թփերի ներկայացուցիչների ծաղկափոշու ուսումնասիրությունը (Angiospermae. X. *Rosaceae*. *Crataegus, Cydonia*, *Malus, Mespilus*, *Padus, Persica, Prunus* ցեղերը): Լուսային (ԼՄ) և սկանեռային էլեկտրոնային (ՍԷՄ) մանրադիտակների օգնությամբ ուսումնասիրվել է Հայաստանի դենդրոֆլորայի *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Mespilus* L., *Padus* Mill., *Persica* Mill., *Prunus* L. (*Rosaceae* Juss. ընտ.) ցեղերին պատկանող 21 տեսակների ծաղկափոշու մորֆոլոգիան:

Ծաղկափոշու մորֆոլոգիա, ծառեր, թփեր, ԼՄ, ՍԷՄ

Айрапетян А. М., Мурадян А. Г. Морфология пыльцы деревьев и кустарников Армении (Angiospermae. X. *Rosaceae*. Роды *Crataegus, Cydonia*, *Malus, Mespilus*, *Padus, Persica, Prunus*). С помощью светового (СМ) и сканирующего электронного (СЭМ) микроскопов изучена пыльца 21 вида деревьев и кустарников Армении из родов *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Mespilus* L., *Padus* Mill., *Persica* Mill., *Prunus* L. (сем. *Rosaceae* Juss.)

Морфология пыльцы, деревья, кустарники, СМ, СЭМ

The results of investigation of pollen morphology of 21 representatives of Armenian trees and shrubs relating to the genera *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Mespilus* L., *Padus* Mill., *Persica* Mill., *Prunus* L. (family *Rosaceae* Juss.) are presented.

MATERIAL AND METHODS

The material studied was obtained from the herbaria of the Institute of Botany after A. Takhtajyan NAS Republic of Armenia, Yerevan (ERE) and Yerevan State University (ERCB).

The descriptions of the pollen grains with the help of the light microscope are based on the grains stained with basic fuchsine (Smoljaninova, Golubkova, 1950), and also on the simplified acetolysis method (Avetisyan, 1950). Pollen grains for the scanning electron microscopes (Jeol, JSM-35; Jeol, JSM-6390) were vacuum sputter-coated with gold and investigated in the laboratory of electronic microscopy of Botanical Institute, St.- Petersburg, Russia.

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

Specimens examined: ***Crataegus*** x *armena* Pojark.: Армения, Азизбековский район, Джермук. Leg. Я. Мулкиджанян (Armenia, Azizbekov district, Jermuk. Leg. Ya. Mulkidzhanyan) (ERE, 73971); АрмССР, около села Личк, 2080 м н.у.м. Leg. С. Туманян (ArmSSR, near the village of Lichk, 2080 m above sea level. Leg. S. Tumanyan) (ERE, 34811); *C. atrofusca* (Steven ex K. Koch) Kassumova; АрмССР, Шамшадинский район, село Верин Агдан, гомер, лес-сад (ArmSSR, Shamshadin district, the village Verin Agdan, barns, forest-garden). Leg. Ya. Mulkijanian (ERE, 84694); Армения, ниже Иджевана, берег реки Акстафы (Armenia, below Ijevan, Akstafa river bank). Leg. A. Takhtadzian (ERE, 26489); *C. caucasica* K. Koch: Армения, Дилижанский заповедник, Дилижанское лесничество, 15 км в сторону Танзут, ю.-з- склон. Leg. Н. Мкртчян (Armenia, Dilijan Reserve, Dilijan Forestry, 15 km towards Tanzut, south-west slope. Leg. N. Mkrtchyan) (ERE, 71126); АрмССР, Микоянский район, между селами Гюлидуз и Кавушлуг. Leg. Я. Мулкиджанян (ArmSSR, Mikoyan district, between the villages Guliduz and Kavushlug. Leg. Ya. Mulkidzhanyan) (ERE, 84645); *C. eriantha* Pojark.: АрмССР, Кафанский район, Шикахохский заповдник, Шюктур-таз. Leg. М. Григорян (ArmSSR, Kafan district, Shikahokh reserve, Shyuktur-taz. Leg. M. Grigoryan)

(ERE, 84661); *C. meyeri* Pojark.: АрмССР, ю.-з. Зангезур, бассейн реки Мегричай, между селом Курис и горой Хошли-даг. Leg. Ш. Асланян (ArmSSR, southwest Zangezur, the Meghrichay river basin, between the village Kuris and Mount Khoshli-dag. Leg. S. Aslanyan) (ERE, 84719); АрмССР, Котайкский район, окрестности монастыря Гехард. Leg. А. Тахтаджян, Э. Габриэлян, В. Аветисян (ArmSSR, Kotayk district, the vicinity of the monastery Geghard. Leg. A. Takhtadzhyan, E. Gabrielyan, V. Avetisyan) (ERE, 84724); *C. orientalis* Pall.: Нахичеванская АССР, верх реки Алинджи, западный склон, горная степь (Nakhichevan ASSR, top of the Alinji River, western slope, mountain steppe). Leg. J. Mulkijaniain, A. Pogosian (ERE, 84681); *C. pentagyna* Waldst. & Kit. ex Willd.: АрмССР, Иджеванский район, Севкарский лесозавод, окрестности моста Сранц, с.-в. склон. Leg. Я. Мулкиджанян (ArmSSR, Ijevan district, Sevkar timber factory, neighborhood of Sranz bridge, north-east slope. Leg. Ya. Mulkidzhanyan) (ERE, 122048); *C. pontica* K. Koch: Армения, Сюник, окрестности села Вагравар. Leg. М. Саркисян (личные сборы) (Armenia, Syunik, surroundings of Vagravar village. Leg. M. Sargsyan (personal collections)); *C. pseudoheterophylla* Pojark.: Нахичеван, Ордубад (Nakhichevan, Ordubad). Leg. G. Ter-Minassian (ERE, 26479); АрмССР, Абовянский район, окрестности монастыря Гехард (ArmSSR, Abovyan district, vicinity of Geghard monastery). Leg. A. Pojarkova (ERE, 84678); *C. rhipidophylla* Gand.: Армения, Ереван, Норк. Leg. Э. Габриэлян (Armenia, Yerevan, Nork. Leg. E. Gabrielyan) (ERE, 82581); АрмССР, Шамшадинский район, село Ахсу. Leg. А. Пояркова (ArmSSR, Shamshadin district, Ahsu village. Leg. A. Pojarkova) (ERE, 84156); АрмССР, Хосровский заповедник, Какавабердский участок, 1575 м н.у.м. Leg. М. Саркисян (ArmSSR, Khosrov Reserve, Kakavaberd plot, 1575 m above sea level. Leg. M. Sargsyan) (ERE, 169636); *C. tournefortii* Griseb.: АрмССР, Ноемберянский район, село Котигех х опушка дубового леса. Leg. Я. Мулкиджанян (ArmSSR, Noyemberyan region, the village Kotigekh x edge of the oak forest. Leg. Ya. Mulkidzhanyan) (ERE, 84637); C. x *ulotricha* Pojark.: Armenia, Sjunik province, road from Goris to Tatev, northern slope of Vorotan gorge, near pavillon. Leg. G. Fajvush, K. Tamanyan, E. Vitek (ERE, 173352); *C.* x *zangezura* Pojark.: АрмССР, Зангезур, Кафанский район, Шикахохский заповедник, Даллаклу. Leg. М. Григорян (ArmSSR, Zangezur, Kafan district, Shikahokh reserve, Dallaklu. Leg. M. Grigoryan) (ERE, 84626); АрмССР, Зангезур, Кафанский район, Шикахохский заповедник, Даллаклу. Leg. М. Григорян (ArmSSR, Zangezur, Kafan district, Shikahokh reserve, Dallaklu. Leg. M. Grigoryan) (ERE, 84630); ***Cydonia*** *oblonga* Mill.: АрмССР, Ереван, Норк, в садах. Leg. Э. Габриэлян (ArmSSR, Yerevan, Nork, in the gardens. Leg. E. Gabrielyan) (ERE, 169696); АрмССР, Мегринский район, село Шванидзор, левый борт ущелья. Leg. Р. Карапетян, Ш. Асланян (ArmSSR, Meghri district, Shvanidzor village, the left side of the gorge. Leg. R. Karapetyan, S. Aslanyan) (ERE, 66593); АрмССР, Ереванский Ботанический сад. Leg. Е. М. Аветисян (личные сборы) (ArmSSR, Yerevan Botanical garden. Leg. E. M. Avetisyan (personal collections)); ***Malus*** *domestica* Borkh.*[1]: Flora of Poland, Koziniec, near Wadorvice. Leg. I. Zelazny (ERE, 80297); *M. orientalis* Uglitzk. ex Juz.: Армения, Ереванский Ботанический сад, участок ”Армянской флоры“. Leg. А. Айрапетян (личные сборы) Armenia, Yerevan Botanical Garden, “Armenian Flora” site. Leg. A. Hayrapetyan (personal collections)); АрмССР, Ноемберянский район, Ламбалинский лесхоз, грабовый лес. Leg. Р. Карапетян, Я. Мулкиджанян (ArmSSR, Noyemberyan region, Lambalu forestry, hornbeam forest. Leg. R. Karapetyan, Ya. Mulkidzhanyan) (ERE, 66943); ***Mespilus*** *germanica* L.: АрмССР, бассейн реки Мегри-чай, правый борт ущелья (ArmSSR, Meghri Chai river basin, starboard side of the gorge). Leg. A. Doluchanov (ERE, 39417); АрмССР, Кафанский район, Бартасский заказник, село Цав, 1500 м н.у.м. Leg. М. Григорян (ArmSSR, Kafan district, Bartass reserve, Tsav village, 1500 m above sea level Leg. M. Grigoryan) (ERE, 165900); ***Padus*** *avium* Mill. (= *P. racemosa* (Lam.) Gilib.): АрмССР, Дарачичаг, лес, северо-восточный склон. Leg. Т. Кузьмин (ArmSSR, Darachichag, forest, northeastern slope. Leg. T. Kuzmin) (ERE, 21026); Окрестности Джелал-оглы, в лесу. Leg. А. Б. Шелковников (The surroundings of Jalal-oglu, in the forest. Leg. A. B. Shelkovnikov) (ERE, 21033); АрмССР,

[1] * – cultivated spesies

Гугаркский район, село Маргаовит, северные склоны горы Тежлер, заросли рододендрона. Leg. В. Манакян, С. Притер (ArmSSR, Gugark district, the village of Margaovit, the northern slopes of Mount Tezhler, tangle of rhododendron. Leg. V. Manakyan, S. Priter) (ERE, 117648); ***Persica*** *vulgaris* Mill.*: АрмССР, Ереванский Ботанический сад, участок ”Армянской флоры“. Leg. В. Аветисян (ArmSSR, Yerevan Botanical Garden, “Armenian Flora” plot. Leg. V. Avetisyan) (ERE, 68358); АрмССР, Вединский район, Горован. Leg. А. Меликян (ArmSSR, Vedi district, Horovan. Leg. A. Melikyan) (ERCB, 11516); ***Prunus*** *divaricata* Ledeb.: Армения, Ереванский Ботанический сад, участок ”Армянской флоры“. Leg. Л. Манукян (Armenia, Yerevan Botanical Garden, “Armenian Flora” plot. Leg. L. Manukyan) (ERE, 75783); Армения, Ереванский Ботанический сад, участок ”Армянской флоры“. Leg. А. Айрапетян (личные сборы) (Armenia, Yerevan Botanical Garden, “Armenian Flora” plot. Leg. A. Hayrapetyan (personal collections); *P. spinosa* L.: АрмССР, Арзнинское ущелье, в ложбине. Leg. Н. Троицкий (ArmSSR, Arzni gorge, in a hollow. Leg. N. Troitsky) (ERE, 26735); АрмССР, Ехегнадзорский район, монастырь Спитакавор, 1800-2000 м н.у.м. Leg. Н. Ханджян (ArmSSR, Yeghegnadzor district, Spitakavor monastery, 1800-2000 m above sea level Leg. N. Khanjyan) (ERE, 113321).

RESULTS

Crataegus L.

Jonas, 1952; Avetisyan, Manukyan, 1958; Reitsma, 1966; Demchenko, 1967; Byatt, 1976; Kuprianova, Alyoshina, 1978; Eide, 1981; Kocon, Muszynski, 1982; Fedoronchuk, Savitskii, 1985; Hebda et al., 1988; Hedba, Chinnappa, 1990; Christensen, 1992; Jones et al., 1995; Dönmez, 2008; Konyar & Dane. 2012; Hayrapetyan et al., 2015; Wronska-Pilarek et al., 2013; Perveen, Qaiser, 2014; Karpovich et al., 2015 (plate 1, phototables I-V)

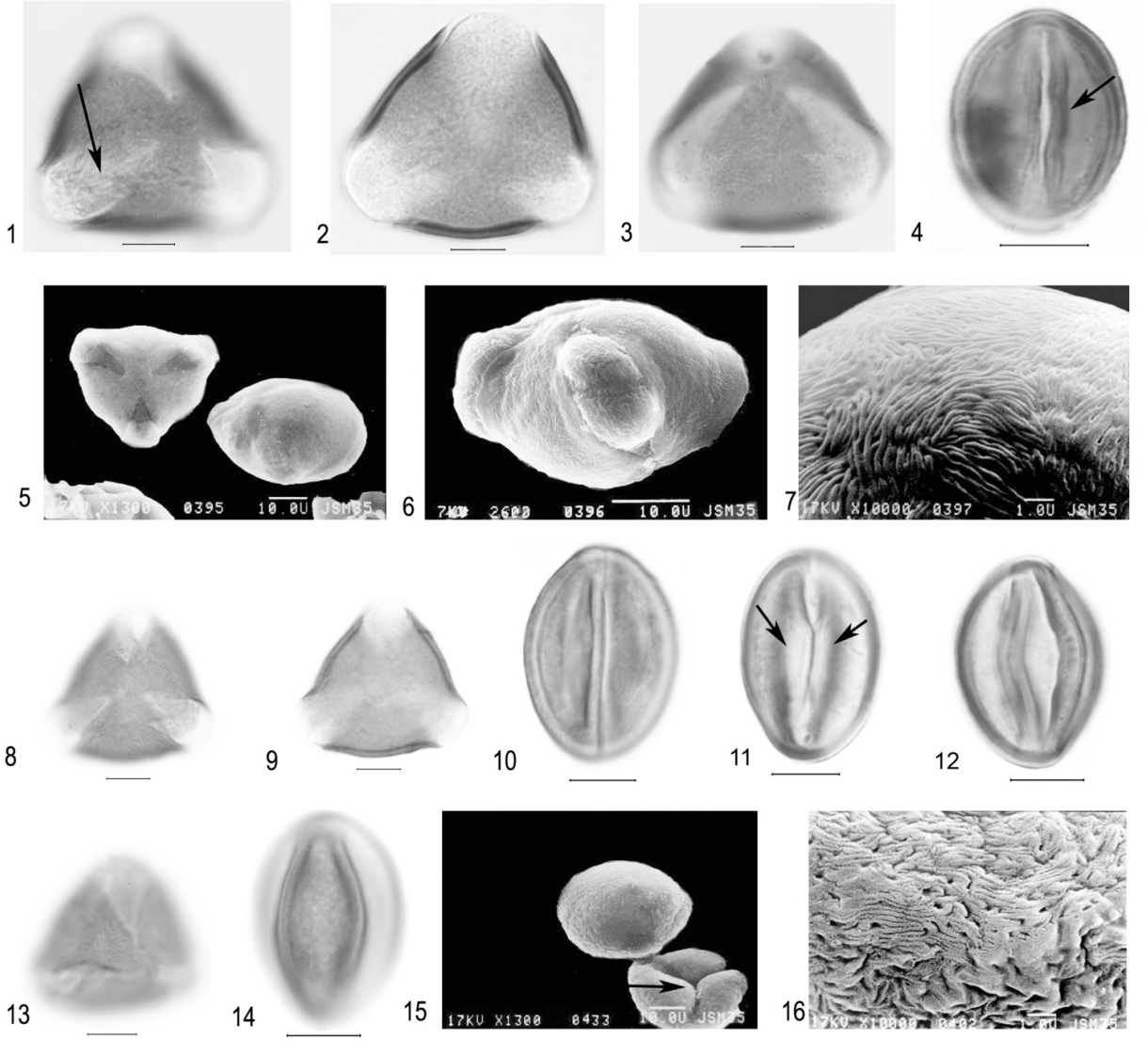
Trees or shrubs.The number of species in Armenia – 22.

Pollen grains 3(4)-zonocolp-poroidate (porate), from oblong to oblate, outline in polar view rounded-3(4)-angular or rounded-3(4)-lobed; polar axis 18,5-32,2 μm, equatorial diameter 14,5-33,6 μm. Colpi sometimes geniculate, long, with thickened edges and with rounded or pointed, sometimes anastomosing ends (synaperturate) (*C. atrofusca* (Steven ex K. Koch) Kassumova; *C. orientalis* Pall., *C. pontica* K. Koch); colpus membrane ornamentation from almost smooth to densely granular (C. x armena Pojark.), sometimes granules are located exclusively along the middle part of the colpi (*C. orientalis* Pall*., C. rhipidophylla* Gand.); apocolpium diameter 3,8-8,4 μm, mesocolpium width 12,5-22,8 μm. Pores usually weakly expressed, almost circular. Exine 1,3-2,1 μm, columellae separate, with rounded ends. Exine ornamentation finely striate or finely reticulate-striate (LM), exine ornamentation is represented with variations of striate sculpture (SEM).

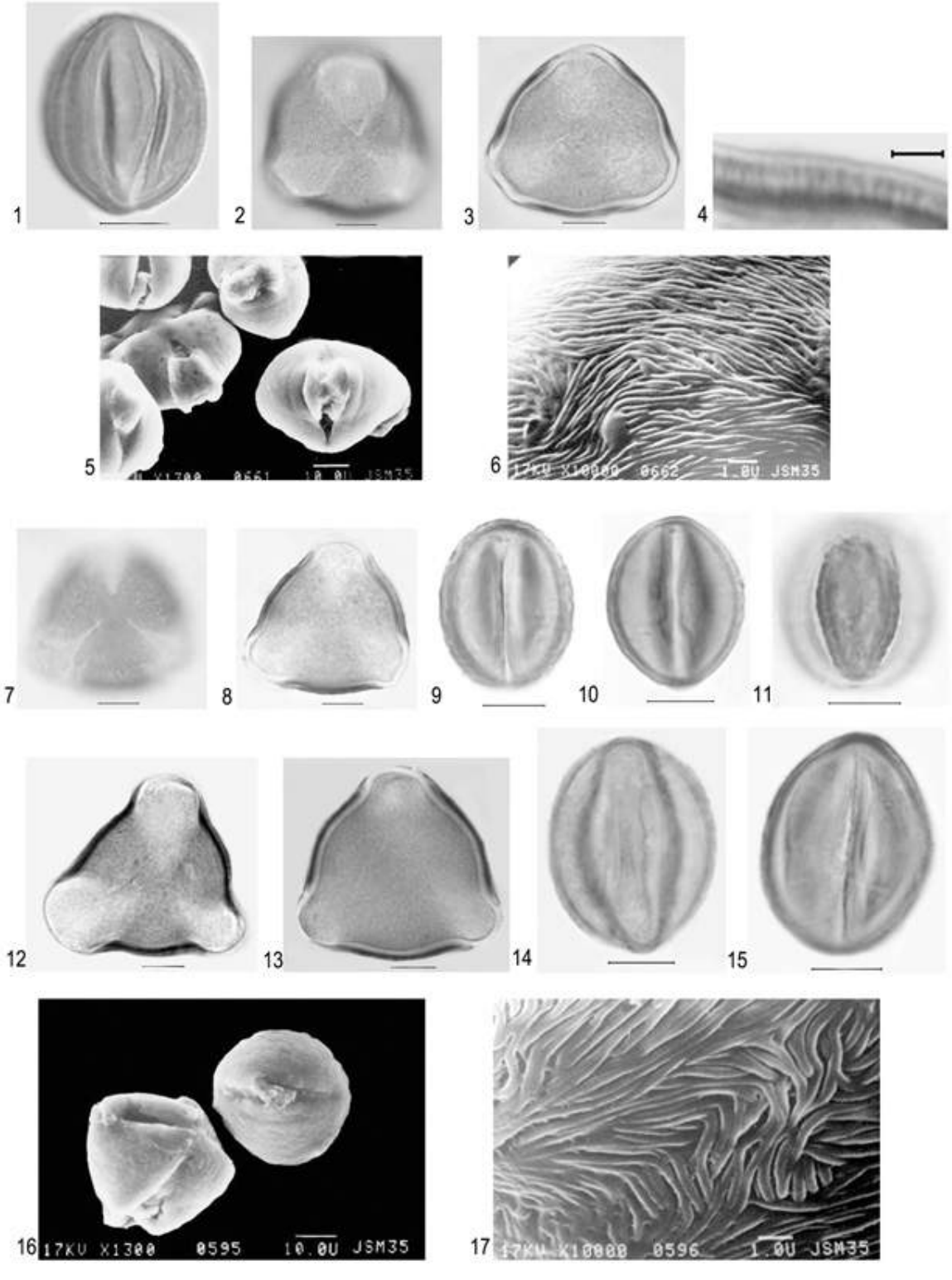
Plate 1. Palynomorphological characteristics of some species of the genus *Crataegus* L.

Species	Pollen grain size (P x E)[1] (μm)	Colpus		Exine ornamentation	
		apocolpium diameter (μm)	mesocolpium width (μm)	LM	SEM
C. x *armena* Pojark.	18,5-23,2 x 18,1-29,8	4,5-7,3	18,2-20,4	striate, reticulate-striate	perforate-striate, striae short, sinuous
C. atrofusca (Steven ex K. Koch) Kassumova	18,7-25,5 x 17,9-28,5	6,8-8,2	18,3-21,0	finely striate	perforate-finely sinuously plicate
C. caucasica K. Koch	19,4-23,5 x 23,6-32,4	4,5-6,2	17,4-18,3	finely striate	perforate-striate, striae short
C. eriantha Pojark.	23,5-25,5 x 18,7-22,8	7,4-8,2	16,8-18,1	finely striate, striae short	–
C. meyeri Pojark.	26,8-31,4 x 23,2-25,2	3,8-5,6	18,6-22,4	finely reticulate-striate	sinuously striate, striae short, often branched
C. orientalis Pall.	22,2-32,2 x 22,8-33,6	4,8-7,8	18,4-21,2	finely reticulate-striate	striate, plicate-striate, striae short
C. pentagyna Waldst. & Kit. ex Willd.	23,5-28,8 x 20,2-25,4	3,8-4,2	17,8-20,8	finely reticulate-striate	–
C. pontica K. Koch	21,8-25,7 x 19,2-23,4	8,0-8,3	17,2-21,0	finely reticulate	plicate-striate, striae short
C. pseudoheterophylla Pojark.	22,1-25,2 x 17,6-20,2	4,5-6,2	16,8-18,5	finely reticulate-striate	perforate-sinuously striate, striae short
C. rhipidophylla Gand.	23,6-26,4 x 14,5-22,4	7,9-8,4	14,2-16,4	finely reticulate-striate	perforate-striate, striae short, often branched
C. tournefortii Griseb.	23,2-25,1 x 14,8-18,2	3,8-5,1	12,5-14,7	finely reticulate-striate	–
C. x *ulotricha* Pojark.	22,5-27,9 x 17,6-20,2	4,5-7,3	18,2-21,3	finely reticulate	sinuously striate, striae short, often branched
C. x *zangezura* Pojark.	21,0-23,8 x 15,2-24,4	4,4-6,4	15,6-17,8	finely reticulate	plicate-striate, striae short

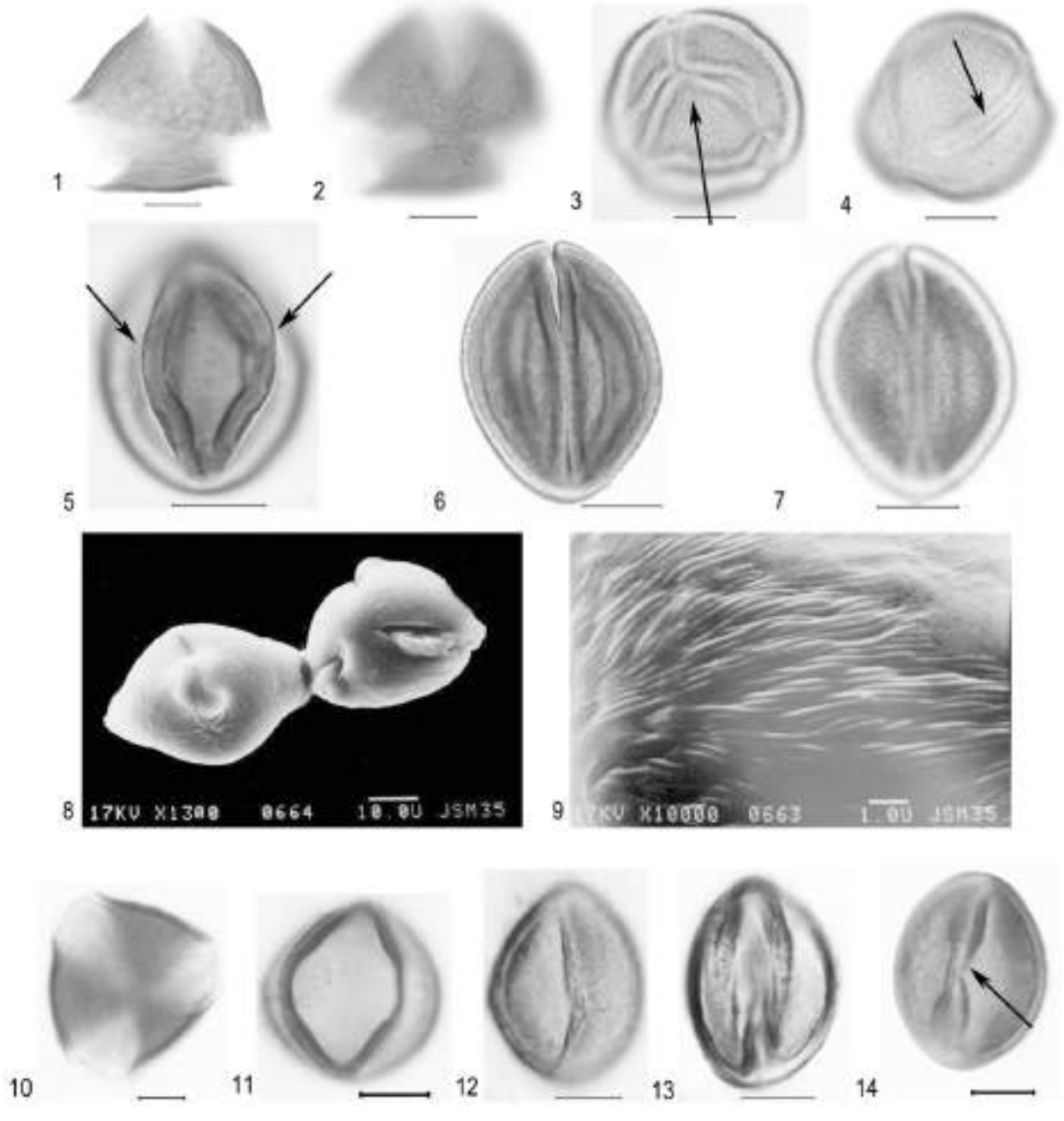
[1] P – polar axis, E – equatorial diameter



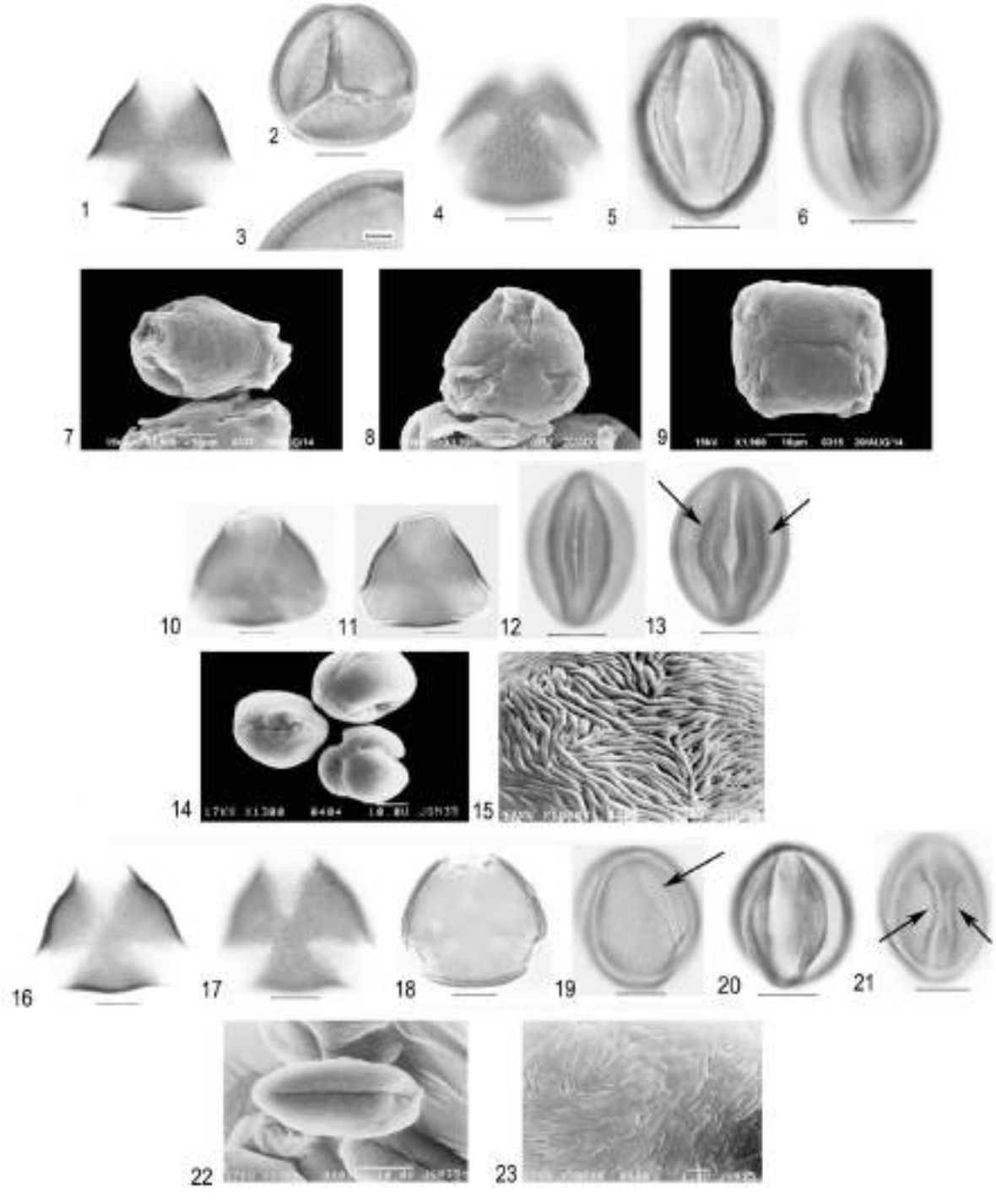
Phototable I. Pollen grains of some species of the genus *Crataegus* L.
1-7 – *C.* x *armena* Pojark. : 1, 2 – pollen grains from polar view (1 – coplus membrane ornamentation, marked by arrow), 3 – pollen grain from semipolar view, 4 – pollen grain from equatorial view (colpus, thickening of colpi edges, marked by arrow) (LM), 5 – pollen grains from polar and equatorial view, 6 – pollen grain from equatorial view (colpus), 7 – exine ornamentation (SEM); 8-16 – *C. atrofusca* (Steven ex K. Koch) Kassumova: 8, 9, 13 – pollen grains from polar view, 10-12, 14 – pollen grain from equatorial view (11 – colpus with geniculum, 14 – mesocolpium) (LM), 15 – pollen grains from polar and equatorial view (syncolpate pollen, marked by arrow), 16 – exine ornamentation (SEM) (scale bar: 1-4, 8-14 – 10 μm)



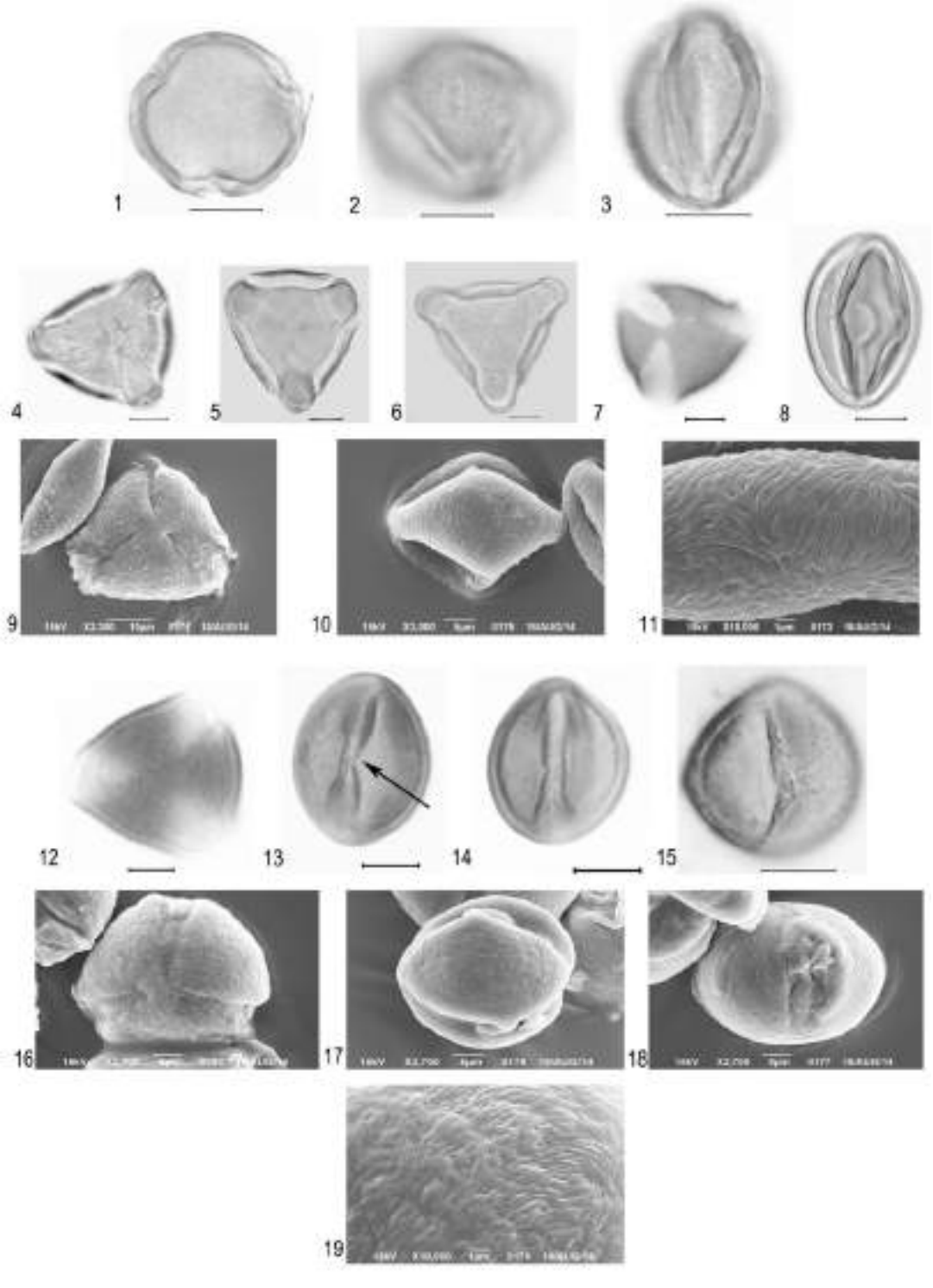
Phototable II. Pollen grains of some species of the genus *Crataegus* L.
1-6 – *C. caucasica* K. Koch: 1 – pollen grain from equatorial view, 2, 3 – pollen grains from polar view, 4 – exine (LM), 5 – pollen group, 6 – exine ornamentation (SEM); 7-11 – *C. eriantha* Pojark.: 7, 8 – pollen grains from polar view, 9-11 – pollen grain from equatorial view (9, 10 – colpus, 11 – mesocolpium) (LM); 12-17 – *C. meyeri* Pojark.: 12, 13 – pollen grains from polar view, 14, 15 – pollen grains from equatorial view (LM), 16 – pollen group, 17 – exine ornamentation (SEM)
(scale bar: 1-3, 7-15 – 10 μm, 4 – 3 μm)



Phototable III. Pollen grains of some species of the genus *Crataegus* L.
1-9 – *C. orientalis* Pall.: 1, 2 – pollen grains from polar view, 3, 4 – pollen grain from semipolar view (3 – syncolp, 4 – coplus membrane ornamentation, marked by arrows), 5-7 – pollen grains from equatorial view, colpi (5 – thickening of colpi edges marked by arrows, 7 – exine ornamentation) (LM), 8 – pollen grains from polar and equatorial view, 9 – exine ornamentation (SEM); 10-14 – *C. pentagyna* Waldst. & Kit. ex Willd.: 10 – pollen grain from polar view, 11-14 – pollen grains from equatorial view (14 – colpus with geniculum, marked by arrow) (LM) (scale bar: 1-7, 10-14 – 10 μm)



Phototable VI. Pollen grains of some species of the genus *Crataegus* L.
1-9 – *C. pontica* K. Koch: 1, 2 – pollen grains from polar view (2 – syncolp), 3 – exine, 4 – pollen grain from semipolar view (exine ornamentation), 5, 6 – pollen grains from equatorial view (5 – exine ornamentation) (LM), 7 – pollen grain from equatorial view (mesocolpium), 8, 9 – pollen grains from polar view (8 – 3-aperturate, 9 – 4-aperturate pollen grains) (SEM); 10-15 – *C. pseudoheterophylla* Pojark.: 10, 11 – pollen grains from polar view, 12, 13 – pollen grain from equatorial view (13 – thickening of colpi edges, marked by arrows) (LM), 14 – pollen group, 15 – exine ornamentation (SEM); 16-23 – *C. rhipidophylla* Gand.: 16-18 – pollen grains from polar view, 19-21 – pollen grain from equatorial view (19 – coplus membrane ornamentation and 21 – colpus with geniculum, marked by arrows (LM), 22 – pollen grain from equatorial view (colpus) 23 – exine ornamentation (SEM)
(scale bar: 1, 2, 4-6, 10-13, 16-21 – 10 μm, 3 – 3 μm)



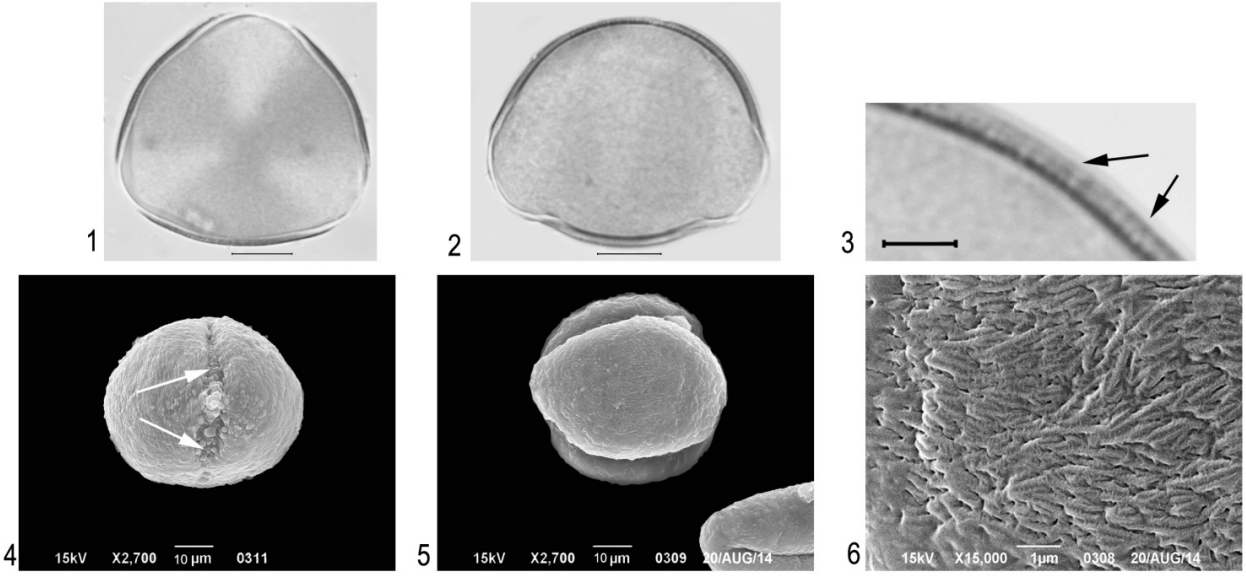
Phototable V. Pollen grains of some species of the genus *Crataegus* L.
1-3 - *C. tournefortii* Griseb.: 1 – pollen grain from polar view, 2 – pollen grain from semipolar view, 3 – pollen grain from equatorial view (LM); 4-11 - C. x *ulotricha* Pojark.: 4-7 – pollen grains from polar view, 8 – pollen grain from equatorial view (LM), 9 – pollen grain from polar view, 10 – pollen grain from equatorial view (mesocolpium), 11 – exine ornamentation (SEM); 12-19 – *C.* x *zangezura* Pojark.: 12 – pollen grain from polar view, 13-15 – pollen grains from equatorial view (13 – colpus with geniculum, marked by arrow) (LM), 16 – pollen grain from polar view, 17, 18 – pollen grains from equatorial view (17 – mesocolpium, 18 – colpus), 19 – exine ornamentation (SEM)
(scale bar: 1-8, 12-15 – 10 μm)

Cydonia Mill.

Avetisyan, Manukyan, 1958; Demchenko, 1967; Abrahamian, 1978

Shrubs or trees. The number of species in Armenia – 1.

C. oblonga Mill. (phototable VI). Pollen grains 3(4)-zonocolp-poroidate (porate), almost spheroidal or oblate in shape, outline in polar view rounded-triangular; polar axis 32,8-41,3 μm, equatorial diameter 38,5-41,0 μm. Colpi long, not wide, the ends slightly rounded; apocolpium diameter 7,0-7,5 μm, mesocolpium width 18,4-25,5 μm; colpus membrane ornamentation heteroverrucate (SEM). Pores usually weakly expressed, with laciniate margins. Exine 1,3-1,6 μm, columellae separate, regularly spaced, with rounded ends, sometimes paired together at the ends (phototable VI, 3). Exine ornamentation densely finely granulate (LM), exine ornamentation perforate-finely striate (SEM).



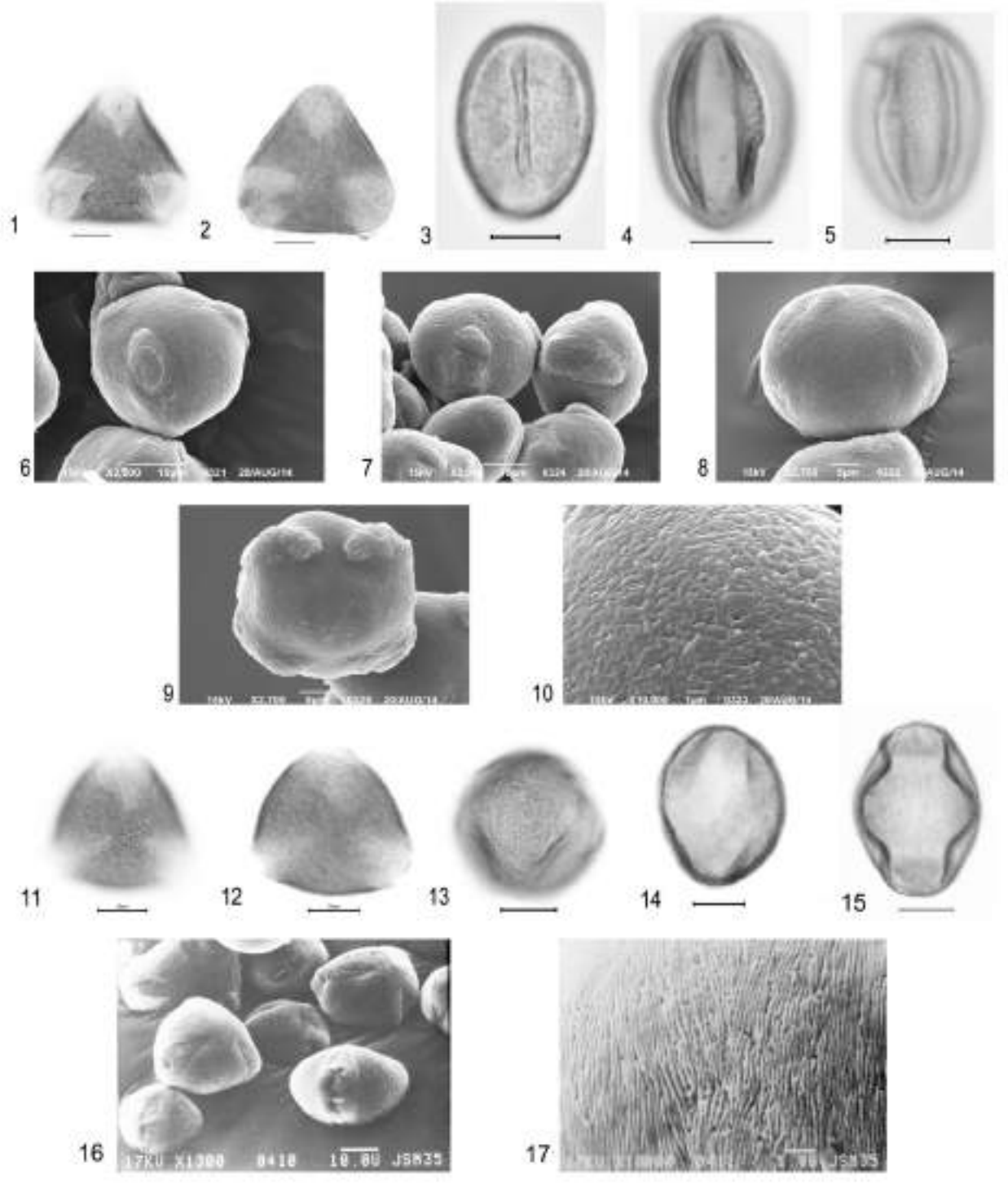
Phototable VI. Pollen grains of *Cydonia oblonga* Mill.
1 – pollen grain from polar view, 2 – pollen grain from equatorial view (mesocolpium), 3 – exine, columellae (marked by arrows) (LM), 4, 5 – pollen grains from equatorial view (4 – colpus with verrucate membrane, marked by arrows, 5 – mesocolpium), 6 – exine ornamentation (SEM)
(scale bar: 1, 2 – 10 μm, 3 – 3 μm)

Malus Mill.

Jonas, 1952; Avetisyan, Manukyan, 1958; Erdtman et al., 1961; Kuprianova, Alyoshina, 1978; Eide, 1981; Xiang, Sheng, 1991; Jones et al., 1995; Joneghani, 2008; Polevova et al., 2012; Perveen, Qaiser, 2014; Karpovich et al., 2015
(plate 2, phototable VII)

Trees. The number of species in Armenia – 2.

Pollen grains 3(4)-zonocolp-poroidate (porate), from oblong to oblate, outline in polar view rounded-3(4)-angular; polar axis 18,5-30,2 μm, equatorial diameter 17,5-25,1 μm. Colpi long (*M. orientalis* Uglitzk.), in *M. domestica* Borkh. colpi of medium length or short, mostly widish, sometimes with thickened edges (*M. domestica*), colpi ends pointed or slightly rounded, ornamentation of the colpus membrane densely granular; apocolpium diameter 4,5-11,0 μm, mesocolpium width 14,1-19,4 μm. Pores usually weakly expressed, with uneven edges. Exine 0,8-1,0 μm, slightly elevated to the pores, columellae straight, thin. Exine ornamentation granulate-finely striate or finely reticulate (LM), exine ornamentation perforate-finely plicate, perforate-granulate-finely plicate (*M. domestica*), finely striate or finely striate-reticulate (*M. orientalis*) (SEM).



Phototable VII. Pollen grains of some species of the genus *Malus* Mill.
1-10 – *M. domestica* Borkh.: 1, 2 – pollen grains from polar view, 3-5 – pollen grains from equatorial view (3, 4 – colpus, 5 – mesocolpium) (LM), 6, 8 – pollen grains from equatorial view (6 – colpus, 8 – mesocoplium), 7 – pollen grains, general view, 9 – 4-aperturate pollen grain, polar view, 10 – exine ornamentation (SEM); 11-17 – *M. orientalis* Uglitzk.: 11, 12 – pollen grains from polar view, 13-15 – pollen grains from equatorial view (LM), 16 – pollen grains from polar and equatorial view, 17– exine ornamentation (SEM)
(scale bar: 1-5, 11-15 – 10 μm)

Plate 2. Palynomorphological characteristics of some species of the genus *Malus* Mill.

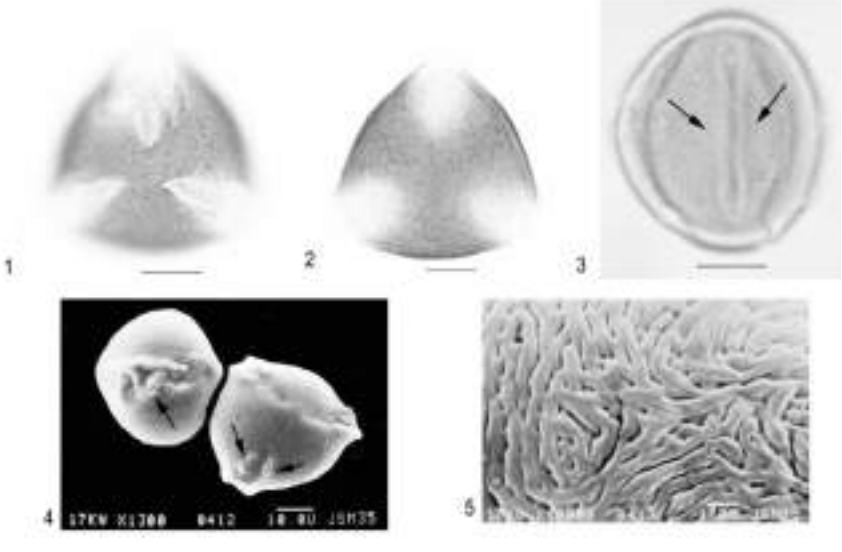
Species	Pollen grain size (P x E) (μm	Colpus		Exine ornamentation	
		apocolpium diameter (μm)	mesocolpium width (μm)	LM	SEM
M. domestica Borkh.*	25,7-28,9 x 17,5-20,7	8,2-11,0	17,2-18,1	finely striate	perforate-finely plicate, perforate-granulate-finely plicate
M. orientalis Uglitzk.	18,5-30,2 x 23,5-25,1	4,5-7,3	14,1-19,4	finely reticulate	finely striate, finely striate-reticulate

Mespilus L.

Avetisyan, Manukyan, 1958; Reitsma, 1966; Demchenko, 1967; Byatt, 1976; Kuprianova, Alyoshina, 1978; Eide, 1981

Shrubs. The number of species in Armenia – 1.

M. germanica **L.** (phototable VIII). Pollen grains 3-zonocolp-poroidate (porate)[1], oblate or almost spheroidal in shape, outline in polar view rounded-triangular; polar axis 28,5-32,4 μm, equatorial diameter 26,4-28,5 μm. Colpi sometimes geniculate, long, from wide to narrow, with thickened edges, the ends rounded or slightly pointed; apocolpium diameter 6,5-10,0 μm, mesocolpium width 20,4-22,5 μm. Pores usually weakly expressed, with uneven edges. Exine 1,5-1,6 μm, columellae thin, with thickened heads. Exine ornamentation finely reticulate (LM), exine ornamentation sinuously finely striate-reticulate (SEM).



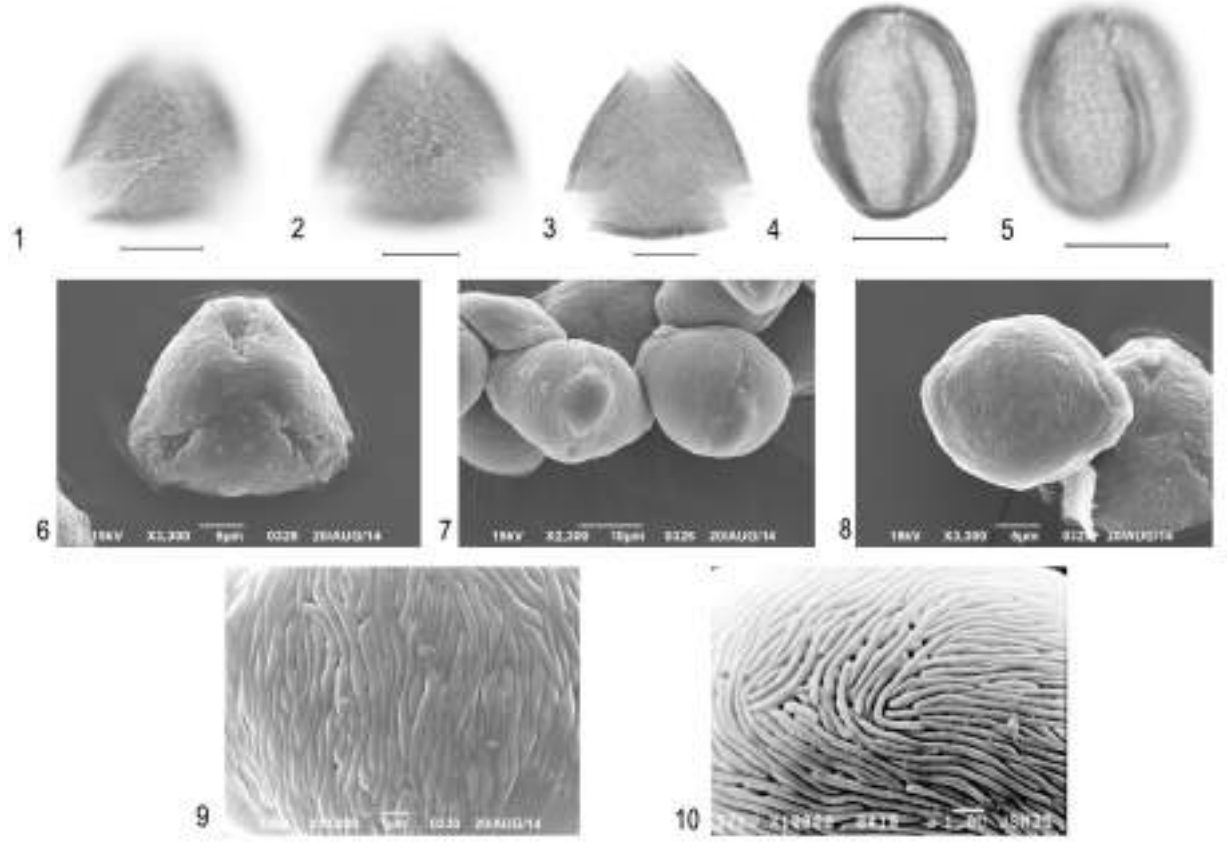
Phototable VIII. Pollen grains of *Mespilus germanica* L.
1, 2 – pollen grains from polar view, 3 – pollen grain from equatorial view (colpus, thickening of colpi edges, marked by arrows) (LM), 4 – pollen grains from polar and equatorial view (geniculum on the left pollen grain and thickening of colpi edges on the right one, marked by arrows), 5 – exine ornamentation (SEM) (scale bar: 1-3 – 10 μm)

[1] Kupriyanaova, Alyoshina (1978) are characterized the pollen of this species as 3-colp-orate, but on the photomicrography of pollen grain from the polar view (phototable XIV, 10) we did not find any os.

Padus Mill.
Jonas, 1952; Avetisyan, Manukyan, 1958; Praglowski, 1962; Shi et al., 2013; Karpovich et al., 2015

Shrubs or small trees. The number of species in Armenia – 1

P. avium Mill. (= ***P. racemosa*** (Lam.) Gilib.) (phototable IX). Pollen grains 3-zonocolp-poroidate (porate), from oblong to oblate, outline in polar view triangular or rounded triangular; polar axis 16,4-23,5 μm, equatorial diameter 16,5-23,1 μm. Colpi long, not wide or narrow, with slightly uneven edges and pointed ends; apocolpium diameter 6,5-7,5 μm mesocolpium width 14,0-16,3 μm. Pores usually weakly expressed, with uneven edges. Exine 1,0-1,2 μm, columellae also weakly expressed. Exine ornamentation finely striate (LM), exine ornamentation perforate-finely striate, striae short, often sinuous (SEM).



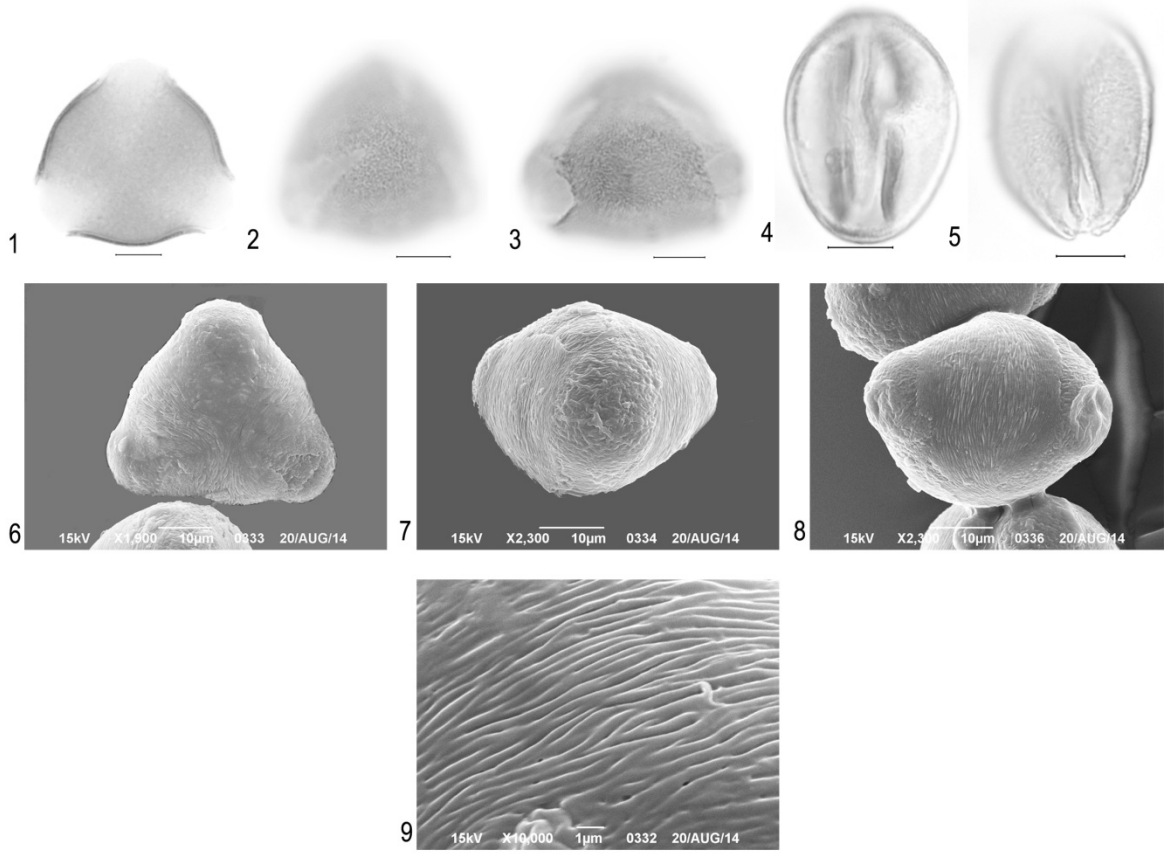
Phototable IX. Pollen grains of *Padus avium* Mill.
1-3 – pollen grains from polar view, 4, 5 – pollen grains from equatorial view (mesocolpium) (LM), 6 – pollen grain from polar view, 7, 8 – pollen grains from equatorial view (7 – colpi, 8 – mesocolpium), 9, 10 – exine ornamentation (SEM) (scale bar: 1-5 – 10 μm)

Persica Mill.
Avetisyan, Manukyan, 1958; Jones et al., 1995; Geraci et al., 2012; Karpovich et al., 2015; Chwil, 2015

Trees. The number of species in Armenia – 1

P. vulgaris Mill.* (phototable X). Pollen grains 3-zonocolp-porate (poroidate), from oblong to oblate, outline in polar view rounded-triangular; polar axis 27,5-34,5 μm, equatorial diameter 22,6-34,5 μm. Colpi predominantly lond and wide, sometimes narrow, with slightly thickened edges, approximated at the equator (phoytotable X, 5), colpi ends rounded or slightly pointed; apocolpium diameter 8,2–9,8 μm; mesocolpium width 22,4–26.6 μm. Pores almost circular, sometimes weakly expressed, pore

diameter 11,5-12,9 μm. Exine 1,0-1,3 μm, columellae thin, straight. Exine ornamentation striate, striae long (LM), exine ornamentation perforate-striate, striae long (SEM).



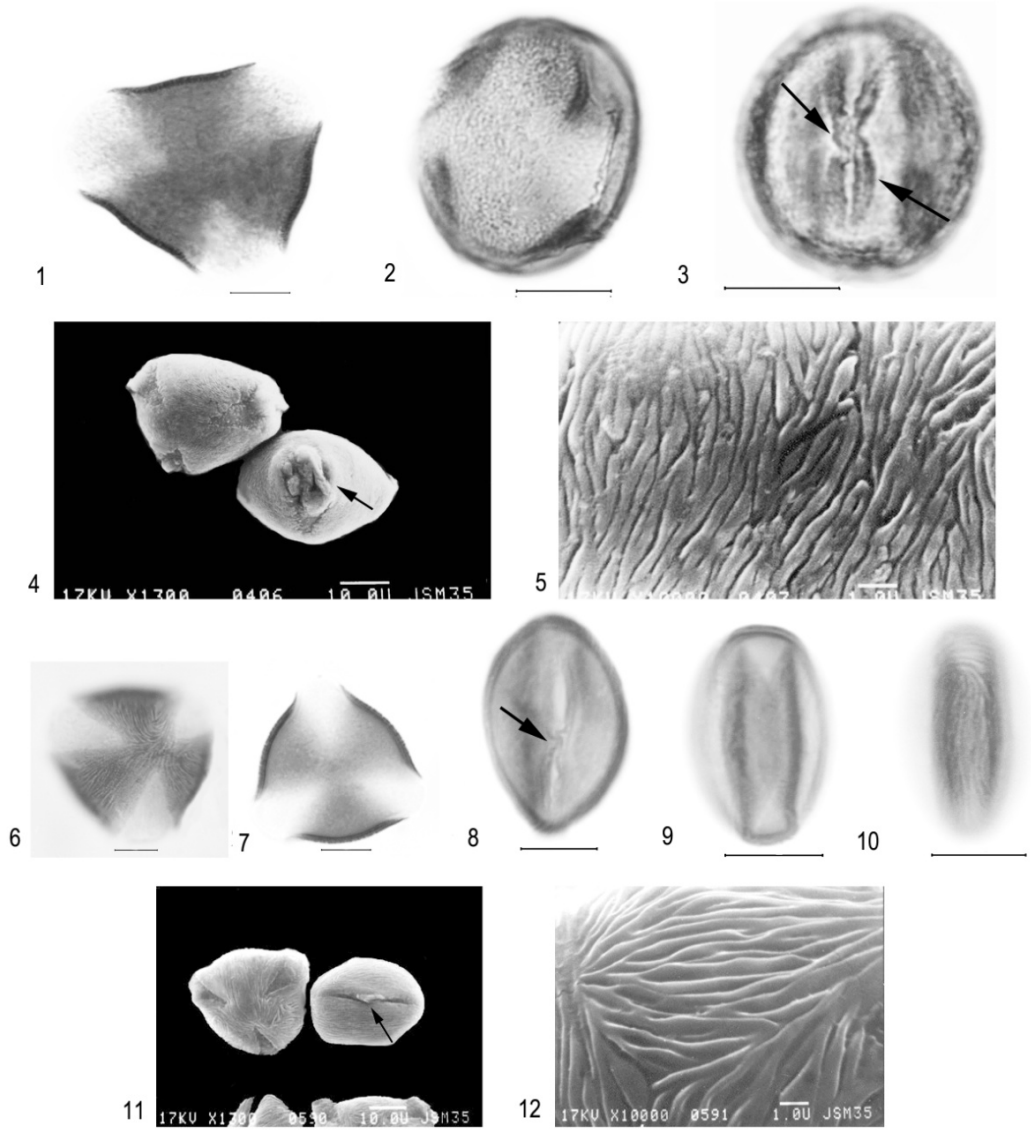
Phototable X. Pollen grains of *Persica vulgaris* Mill.
1, 2 – pollen grains from polar view, 3-5 – pollen grains from equatorial view (3 – mesocolpium, 4, 5-colpi) (LM), 6 – pollen grain from polar view, 7, 8 – pollen grains from equatorial view (7 – colpus, 8 – mesocolpium), 9 – exine ornamentation (SEM)
(scale bar: 1-5 – 10 μm)

Prunus L.

Jonas, 1952; Avetisyan, Manukyan, 1958; Erdtman et al., 1961; Praglowski, 1962; Richard, 1970c; Eide, 1981; Kocon, Muszynski, 1982; Valdes et al., 1987; Hedba, Chinnappa, 1990; Hedba et al., 1991; Jones et al., 1995; Zhou et al., 1999; Geraci et al., 2012; Gosling et al., 2013; Shi et al., 2013; Perveen, Qaiser, 2014; Chwil, 2015; Karpovich et al., 2015; Gajewski et al., 2017; Abdulrahman et al., 2019
(plate 3, phototable XI)

Shrubs or small trees. The number of species in Armenia – 4.

Pollen grains 3-zonocolp-poroidate (porate), from oblong to oblate, outline in polar view rounded-triangular; polar axis 18,6-28,5 μm, equatorial diameter 14,5-24,1 μm. Colpi geniculate (phototable XI, 3, 4, 8, 11), long, wide *(P. divaricata* Ledeb.), with thickened edges (phototable XI, 3); apocolpium diameter 5,3–8,3 μm, mesocolpium width 12.5–20.2 μm. Pores usually weakly expressed. Exine 1,2-1,4 μm, columellae thick, with small rounded heads, sometimes drawing together (phototable XI, 1, 7). Exine ornamentation is represented with variations of striate sculpture (LM, SEM).



Phototable XI. Pollen grains of some species of the genus *Prunus* L.
1-5 – *P. divaricata* Ledeb.: 1 – pollen grain from polar view, 2, 3 – pollen grains from equatorial view (2 – mesocolpium, 3 – geniculate colpus with thickened edges, marked by arrows) (LM), 4 – pollen grains from polar and equatorial view, 5 – exine ornamentation (SEM); 6-12 – *P. spinosa* L.: 6, 7 – pollen grains from polar view, 8-10 – pollen grains from equatorial view (8 – geniculate colpus, 9, 10 – mesocolpium), 11 – pollen grains from polar and equatorial view (geniculate pollen, marked by arrow), 12 – exine ornamentation (SEM)
(scale bar: 1-3, 6-10 – 10 μm)

Plate 3. Palynomorphological characteristics of some species of the genus *Prunus* L.

Species	Pollen grain size (P x E) (μm)	Colpus		Exine ornamentation	
		apocolpium diameter (μm)	mesocolpium width (μm)	LM	SEM
P. divaricata Ledeb.	18,6-23,8 x 21,0-23,7	7,5-8,3	12,5-14,2	reticulate-striate	perforate-striate, striae short
P. spinosa L.	23,2-28,5 x 14,5-24,1	5,3-7,8	18,6-20,2	striate	plicate-striate

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