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MICROMORPHOLOGY OF POLLEN GRAINS OF FRUIT TREES OF THE GENUS *Prunus*

Mirosława Chwil
University of Life Sciences in Lublin

Abstract. The micromorphological characteristics of the pollen grain sculpture is one of the most important diagnostic traits in plants. Pollen grains in various species of the subfamily Prunoideae are characterized by variations in size, shape and exine sculpture. In the present work, for the first time, the micromorphology of pollen grains of fourteen cultivars from five fruit tree species of the genus Prunus was compared. Morphometric observations and analysis of pollen grains were performed using light and electron scanning microscopy. In terms of size, the pollen grains studied were classified as medium sized and large. Their shape was determined to be *prolate*, *subprolate*, or *prolate spheroidal*. The striae in the exine of *P. armeniaca* run parallel and can be branched or curved. The sculpture of *P. persica* grains shows elongated extending paralel regular and irregular striae, dichotomously branched. Regularly arranged, or at places branched, striae are found in the exine of *P. avium* pollen grains. The ornamentation of *P. cerasus* grains is composed of elongated striae, sometimes slightly curved or with a tendency to intertwine. The exine of *P. domestica* grains is characterized by forked, arched striae. The stria thickness differs significantly between cultivars within the species, while the groove width differs only between some species and cultivars. The obtained results on the exine sculpture of pollen grains can be used in the taxonomy of species of the genus *Prunus*.

Key words: *Prunus,* pollen grains, micromorphology, exine, sculpture, SEM

INTRODUCTION

Fruit trees of the genus *Prunus*, family Rosaceae, subfamily Prunoideae: *P. armeniaca*, *P. persica*, *P. avium*, *P. cerasus* and *P. domestica* trees, play an important role due to the consumption of fresh fruit and the use of their fruits in different branches of the food industry. The above-mentioned trees are classified as bee plants, while some of them are considered to be medicinal, cosmetic, and ornamental plants [Podbielkowski and Sudnik-Wójcikowska 2003, Szczęsna 2006a, b, Chwil 2013].

Corresponding author: Mirosława Chwil, Department of Botany, University of Life Sciences in Lublin, Akademicka 15, 20-950 Lublin, Poland, e-mail: miroslawa.chwil@up.lublin.pl

In the great variety of fruit tree cultivars of the genus *Prunus,* the microscopic characters of pollen grains, among others, are a tool for their identification [Hebda and Chinnappa 1990]. Pollen grains have varied surface sculpture and a multilayer cell wall, which consists of an inner intine and an outer two-layered exine. A structureless endoexine is immediately adjacent to the intine. In turn, the ectoexine is composed of three layers: the foot layer, the middle layer composed of *columellae,* and the outer layer called tectum, which is formed as a result of the fused heads of the *columellae.* The tectum can be complete, incomplete, or perforate [Dybova-Jachowicz and Sadowska 2003].

Pollen grains of various species have different physiological and structural adaptations. These include a heterogeneous wall structure, presence of sporopollenin and pollen kit, and heterogeneous sculpture ornamentation. These adaptations allow survival in a dry or humid environment after they are released from the anthers [Katifori et al. 2010]. In the two-layered wall of the pollen grains, the exine is an outer, stiff, and stable protection. These traits are associated with a large amount of sporopollenin (an organic polymer) resistant to external environmental factors [Wiermann and Gubatz 2008, Ariizumi and Toriyama 2011]. The pollen kit on the surface of pollen grains facilitates their adhesion, protects the protoplast against sunlight, and contributes to adherence of pollen grains to the body of pollinators. Pollinators are attracted by aromatic lipid constituents [Bolick 1990, Pacini and Franchi 1993].

In many species of the family Rosaceae, pollen grains are classified as tricolporate (rarely tricolpate) [Vafadar et al. 2010, Wrońska-Pilarek and Jagodziński 2011, Wrońska-Pilarek et al. 2012]. Two types of perforation have been found in the exine sculpture of these plants; the perforations are either large and often extending onto tectal ridges, or they are minute pinholes [Hebda and Chinnappa 1990]. Tricolporate pollen grains are found in the flowers of fruit trees of the genus *Prunus*. The pollen of different cultivars within each species is characterized by variations in size, shape and exine sculpture [Fogle 1977, Sótonyi et al. 2000, Radice and Galati 2006, Gilani et al. 2010, Geraci et al. 2012]. Pollen grains of many taxa of the genus *Prunus* are distinguished by striate sculpture [Sótonyi et al. 2000, Geraci et al. 2012]. In polar view, they have a triangular outline, while in equatorial view an elliptical outline [Arzani et al. 2005, Gilani et al. 2010, Geraci et al. 2012]. The exine of grains forms a pattern of striae characteristic for a particular species [Hebda et al. 1991, Sótonyi et al. 2000, Arzani et al. 2005, Gilani et al. 2010, Geraci et al. 2012]. Stace [1993] considers the micromorphological characters of pollen grains in closely related taxa to be standard taxonomic indicators. In some families, pollen morphology is one of the most important diagnostic characters. According to this author, cariological observations of grains, e.g. the number of nuclei, also provide valuable information. Investigation of the morphology of pollen grains in plants of the family Rosaceae forms the basis for systematic classification of some species [Kuiling et al. 2007]. In the literature, there is a lack of comparative data on the microstructure of the pollen exine in fruit tree cultivars grown in Poland and therefore an attempt was undertaken to complement this knowledge.

The aim of the present study was to investigate the size, shape and micromorphology of the exine sculpture of pollen grains of fourteen cultivars within five species of the genus *Prunus*.

MATERIAL AND METHODS

Study material. The present study included the investigation of the micromorphology of pollen of five fruit tree species of the genus *Prunus*. The following cultivars of these species were analyzed:

– *P. armeniaca* L. 'Harcot', 'Early Orange', 'Wczesna z Morden';
– *P. persica* L. Batsh 'Redhaven', 'Veecling';
– *P. avium* L. 'Kordia', 'Regina', 'Vega';
– *P. cerasus* L. 'Łutówka', 'Northstar', 'Kelleris 16';
– *P. domestica* L. 'Bluefre', 'Cacanska Najbolja', 'Top'.

The study material was collected from sweet cherry (*P. avium*), sour cherry (*P. cerasus*) and plum (*P. domestica*) trees growing in an experimental orchard of the University of Life Sciences in Lublin, located in the Felin district (22°34'E, 51°14'N), while pollen from apricot (*P. armeniaca*) and peach (*P. persica*) trees was sampled in a commercial orchard in the village of Lipnik (21°30'E, 50°44'N). Pollen was sampled from the flowers at the beginning of anthesis. Pollen grains were compared in terms of their morphological characters by determining their size, shape, and exine sculpture. The thickness of striae and the width of grooves between them were determined. The micromorphology of the exine sculpture was observed using light and scanning electron microscopy.

Light microscopy (LM). A comparative analysis was made of the morphology of pollen grains of the studied cultivars using light microscopy. Having been stained with a 1% safranin solution, the grains were mounted in glycerol-gelatin [Green 1991, Wood et al. 1996]. The slides thus prepared were viewed under a Nikon Eclipse 400 light microscope.

Scanning electron microscopy (SEM). The pollen grains were critical-point dried in liquid CO_2 in an EMITECH K850 drier and subsequently coated with gold using an EMITECH K550X sputter coater. The observations of the nectary epidermis surface and pollen grain sculpture as well as photographic documentation were made in a TESCAN VEGA II LMU scanning electron microscope (SEM).

Morphometric analysis. The grain size and shape were determined according to the classification presented in the literature [Erdman 1966, Dybova-Jachowicz and Sadowska 2003]. The grain size was estimated by measuring the length of the equatorial diameter (E) and of the polar axis (P) (n = 150). The P/E ratio was calculated. In the exine sculpture of the pollen grains, the thickness of striae and the width of grooves between them were determined (n = 30). The morphometric analysis was conducted using Nikon NIS-Elements microscope imaging software, version 3.0 Advance Research.

Statistical analysis of the results. The significance of differences between the studied characters in the micromorphology of pollen grains was statistically analyzed using the integrated SAS 9.2 and Statistica 6.0 analytical and statistical software package. Statistical inferences were drawn at a significance level of $\alpha = 0.05$.

RESULTS

Grain size and shape. Pollen grains of the studied species of the genus *Prunus* are classified as tricolporate (fig. 1 A–C; 2 A, D; 3 A–C; 4 A–C; 4 A–C). Among the investigated species, *P. armeniaca* and *P. persica* produce pollen grains with the longest polar axis (> 50 µm), while the equatorial axis is the longest (> 30 µm) in *P. domestica.* The dimensions of these axes in apricot and peach pollen grains are similar and they are 51 and 30 µm, respectively. The average length of the P and E axes in pollen grains of *P. avium, P. cerasus* and *P. domestica* is in the range of 37–44 and 26–35 µm, respectively. The lengths of the above mentioned parameters differ significantly between some species and cultivars.

Table 1. Polar and equatorial length as well as the P/E ratio of pollen grains of the studied cultivars of five species of the genus *Prunus,* µm

Cutivar		Lenght of axis				P/E
		polar (P)		equatorial (E)		
		min.-max.	mean ±SD	min.-max.	mean ±SD	
P. ameniaca	Harcot	40.74–56.25	50.81 ±2.36b	27.09–35.36	31.20 ±1.96a	1.63 ±0.14c
	Early Orange	46.01–52.26	49.20 ±1.58c	25.05–31.56	29.05 ±1.72b	1.69 ±0.12b
	Wczesna z Morden	48.35–58.55	52.34 ±2.10a	25.17–32.25	28.98 ±2.19b	1.81 ±0.15a
	mean	–	50.78 ±2.40A	–	29.74 ±2.22B	1.71 ±0.16A
P. persica	Redhaven	43.85–59.75	51.62 ±3.90a	25.23–36.32	29.77 ±2.55a	1.73 ±0.21a
	Veecling	44.38–55.28	50.23 ±2.13b	26.09–34.10	30.01 ±2.03a	1.67 ±0.14b
	mean	–	50.93 ±3.22A	–	29.89 ±2.30B	1.70 ±0.18A
P. avium	Kordia	38.18–46.96	43.76 ±1.84a	24.83–31.13	27.04 ±1.24a	1.62 ±0.10b
	Regina	38.11–47.82	42.70 ±3.06b	23.54–29.94	26.37 ±1.40b	1.62 ±0.15b
	Vega	38.22–48.95	44.40 ±2.69a	22.25–28.23	25.92 ±1.47c	1.71 ±0.16a
	mean	–	43.61 ±2.67B	–	26.44 ±1.44D	1.65 ±0.15B
P. cerasus	Kelleris 16	31.88–44.38	38.00 ±2.15a	24.38–39.75	28.85 ±1.91ab	1.32 ±0.11a
	Łutówka	30.05–40.87	35.49 ±2.32c	23.56–31.41	28.44 ±1.54b	1.25 ±0.10b
	Northstar	33.19–39.79	36.55 ±1.73b	25.09–33.18	29.09 ±1.54a	1.26 ±0.09b
	mean	–	36.68 ±2.32D	–	28.79 ±1.69C	1.27 ±0.11C
P. domestica	Bluefre	38.55–50.75	43.11 ±2.82a	31.09–43.43	34.96 ±2.21a	1.24 ±0.08a
	Cacanska Najbolja	32.00–49.01	39.95 ±1.78b	23.21–35.40	35.37 ±1.18a	1.13 ±0.06b
	Top	36.09–44.30	39.42 ±1.63b	29.61–39.72	35.34 ±2.67a	1.12 ±0.09b
	mean	–	40.82 ±2.90C	–	35.22 ±2.41A	1.16 ±0.10D

a–c, A–D – means followed by the same small letter are not significantly different between cultivars and those followed by the same capital letter between species at α = 0.05, SD – standard deviation

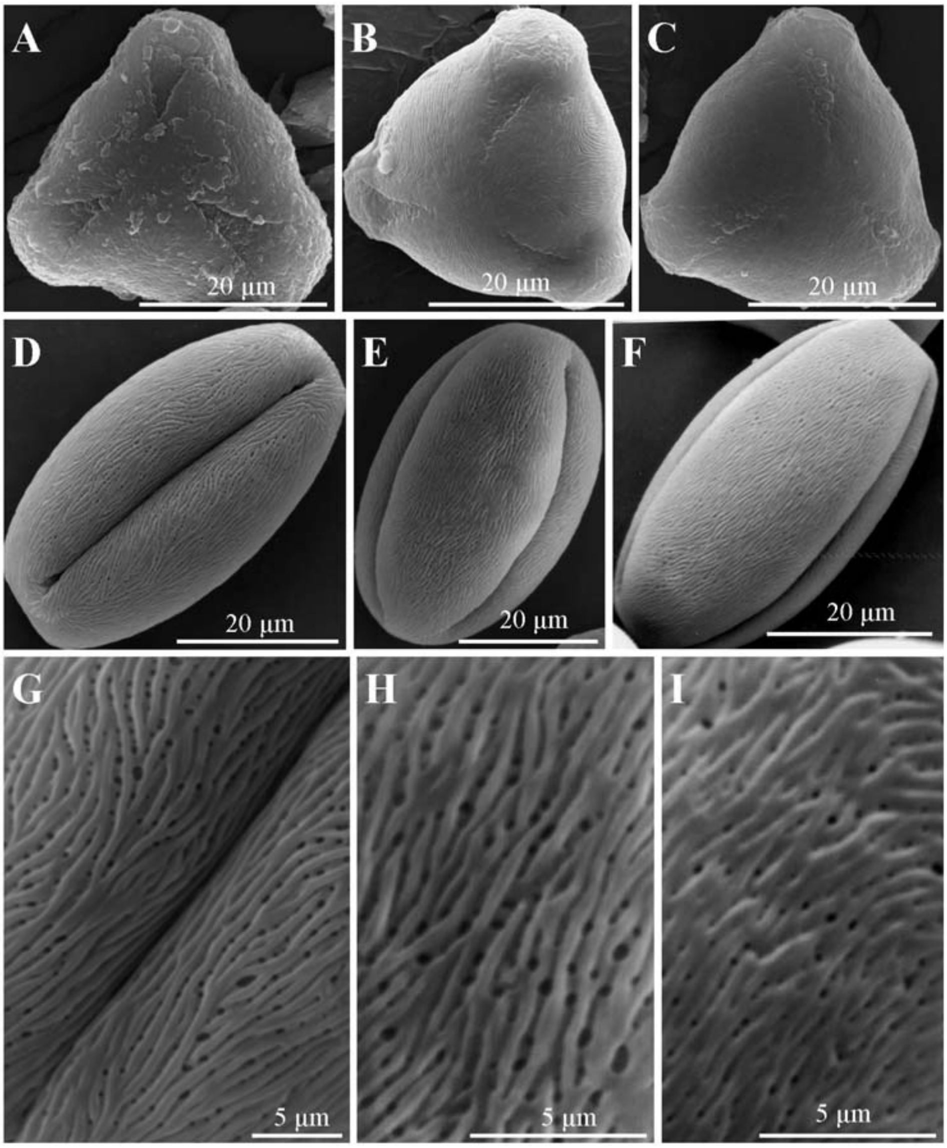

Fig. 1 A–I. Pollen grains of *P. armeniaca*: 'Harcot' (A, D, G), 'Early Orange' (B, E, H), and 'Wczesna z Morden' (C, F, I): A–C – polar view, D–F – equatorial view, G–I – detail of the exine surface, perforations in the tectum are visible

Taking into account the criterion of size, these pollen grains were classified as medium sized (*P. avium*, *P. cerasus* and *P. domestica*) and large (*P. armeniaca* and *P. persica*). The P/E ratio for pollen grains of the studied taxa ranges from 1.16 to 1.71. Based on these values, grains with the following shapes were distinguished: prolate in

P. armeniaca, *P. perlica,* and *P. avium*, subprolate in *P. cerasus* and *P. domestica* ‘Bluefre’, or prolate spheroidal in *P. domestica* ‘Cacanska Najbolja’ and ‘Top’ (tab. 1).

Pollen grain sculpture (SEM). The exine of pollen grains of the species studied forms a pattern of striae characteristic of a particular species. In equatorial view of pollen grains, these structures run along the polar axis (fig. 1 D–F; 2 B, E; 3 D–F; 4 D–F; 5 D–F).

The striae in the exine of *P. armeniaca* run parallel, can be branched or arched (fig. 1 G–I). Their width is from 0.27 (‘Early Orange’) to 0.62 µm (‘Harcot’). The largest distances between them were found in ‘Harcot’ grains (0.33 µm), while in the other cultivars they were shown to be narrower (0.13–0.14 µm) (tab. 2).

Table 2. Width of striae and grooves in the sculpture of pollen grains of the studied cultivars of five species of the genus *Prunus,* µm

Cultivar		Width of			
		striae		grooves	
		min.–max.	mean ±SD	min.–max.	mean ±SD
P. ameniaca	Harcot	0.49–0.82	0.62 ±0.07a	0.23–0.50	0.33 ±0.06a
	Early Orange	0.19–0.38	0.27 ±0.05c	0.10–0.18	0.14 ±0.03b
	Wczesna z Morgen	0.32–0.54	0.43 ±0.05b	0.10–0.19	0.13 ±0.02b
	mean	–	0.47 ±0.16C	–	0.20 ±0.11B
P. persica	Redhaven	0.40–0.76	0.60 ±0.08a	0.13–0.22	0.17 ±0.03a
	Veecling	0.24–0.38	0.31 ±0.04b	0.14–0.18	0.16 ±0.01a
	mean	–	0.46 ±0.16C	–	0.17 ±0.03C
P. avium	Kordia	0.45–0.86	0.60 ±0.12a	0.11–0.28	0.19 ±0.06a
	Regina	0.46–0.73	0.65 ±0.09a	0.12–0.24	0.18 ±0.04a
	Vega	0.48–0.86	0.66 ±0.11a	0.11–0.21	0.16 ±0.04a
	mean	–	0.65 ±0.11B	–	0.17 ±0.05C
P. cerasus	Kelleris 16	0.42–0.92	0.65 ±0.15a	0.11–0.33	0.17 ±0.05a
	Łutówka	0.33–0.73	0.55 ±0.12b	0.10–0.29	0.15 ±0.04b
	Northstar	0.51–0.88	0.69 ±0.10a	0.10–0.19	0.14 ±0.03b
	mean	–	0.63 ±0.14B	–	0.15 ±0.04C
P. domestica	Bluefre	0.73–1.08	0.86 ±0.10a	0.10–0.39	0.20 ±0.10b
	Cacanska Najbolja	0.50–0.89	0.68 ±0.12c	0.19–0.38	0.25 ±0.04a
	Top	0.89–1.54	1.19 ±0.21b	0.19–0.42	0.27 ±0.09a
	mean	–	0.81 ±0.26A	–	0.24 ±0.09A

Designations as in tab. 1

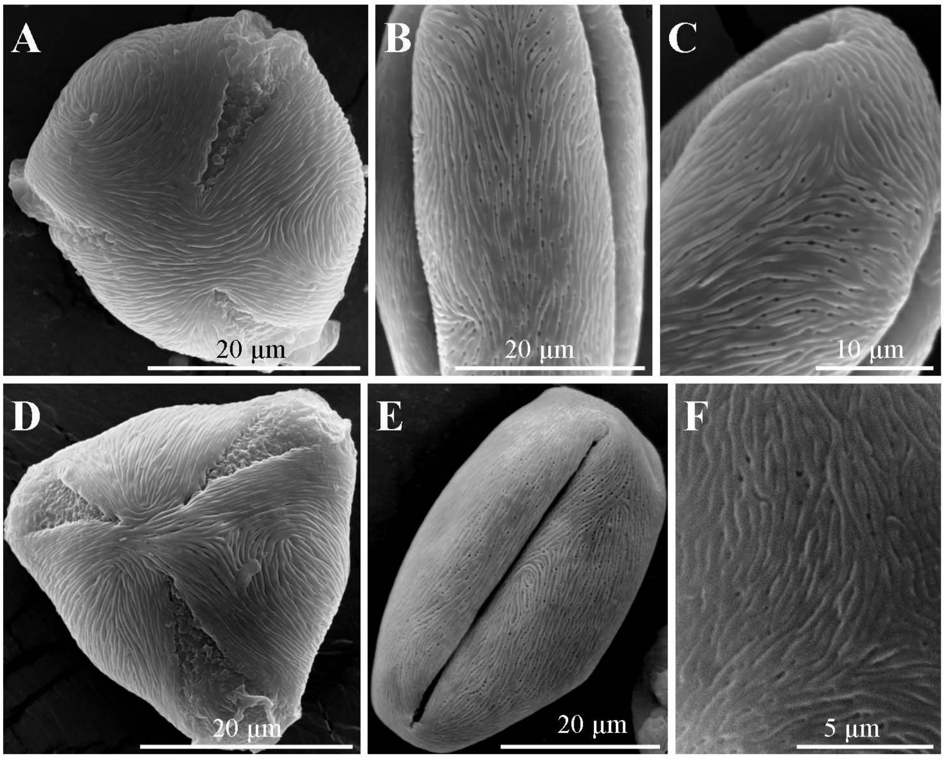

Fig. 2 A–F. Pollen grains of *P. persica* 'Redhaven' (A–C) i 'Veecling' (D–F): A, D – polar view, B, E – equatorial view, C, F – detail of the exine surface, perforations in the tectum are visible

The sculpture of *P. persica* grains shows elongated extending parallel and irregular or dichotomously branched, or sometimes fused striae (fig. 2 C, F) with a thickness from 0.31 ('Veecling') to 0.60 µm ('Redhaven'). The striae are separated by 0.17 µm wide grooves (tab. 2).

Regularly arranged, or at places branched, striae (fig. 3 G–I) with a thickness ranging between 0.60 ('Kordia') and 0.66 µm ('Vega') occur in the exine of *P. avium* pollen grains. The width of grooves between them ranges from 0.16 µm ('Vega') to 0.19 µm ('Kordia') (tab. 2).

The ornamentation of *P. cerasus* pollen grains forms elongated striae, sometimes slightly curved or with a tendency to intertwine (fig. 4 G–I). Their thickness ranges from 0.55 ('Łutówka') to 0.69 µm ('Northstar'). The striae are separated by grooves with a width from 0.14 ('Northstar') to 0.17 µm ('Kelleris 16') (tab. 2).

The exine of *P. domestica* grains forms forked, arched striae, rounded near the poles (fig. 5 G–I), with a diameter in the range of 0.68 ('Cacanska Najbolja') – 1.19 µm ('Top'). Between these striae, there are grooves with a width from 0.20 ('Bluefre') to

0.27 µm (‘Top’) (tab. 2). Among the plum cultivars investigated, the thickest striae with an irregular, sometimes intertwining arrangement, were found in ‘Top’ (fig. 5 I).

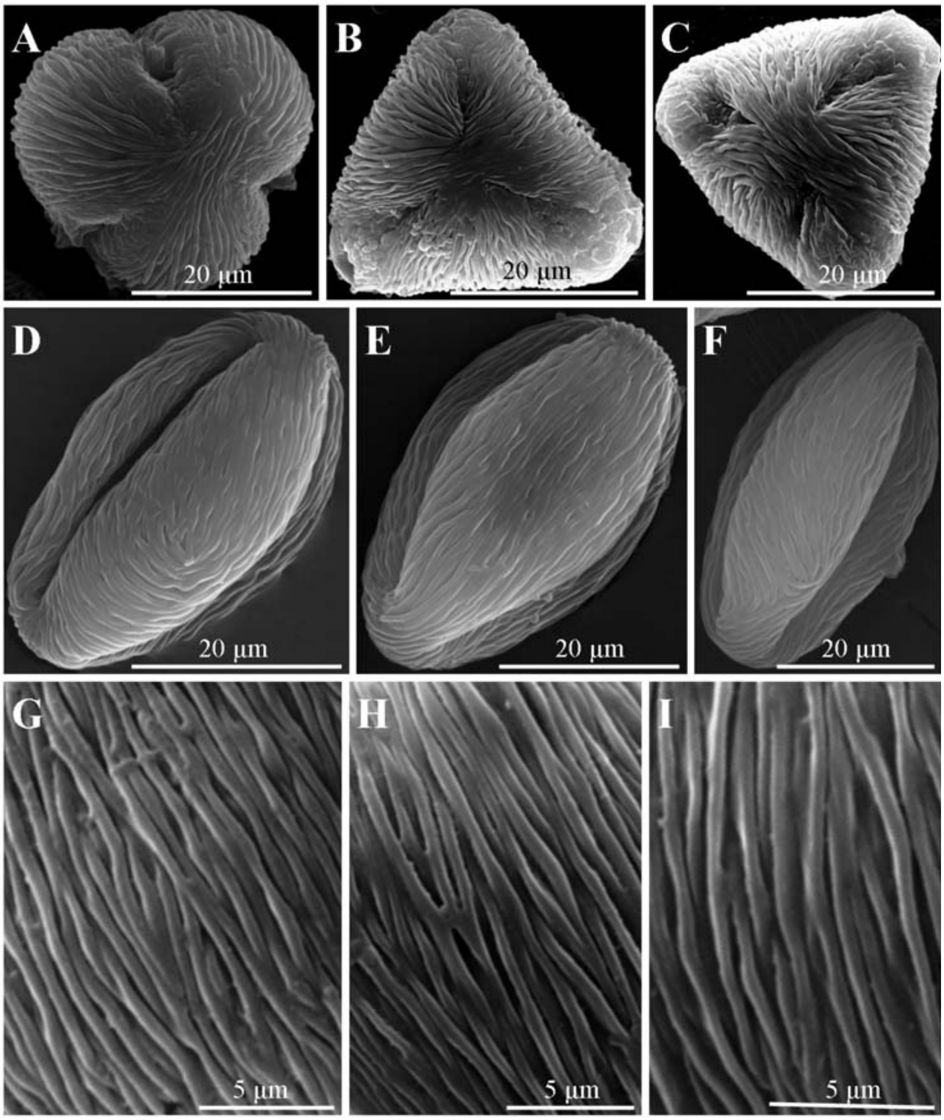

Fig. 3 A–I. Pollen grains of *P. avium* ‘Keleris 16’ (A, D, G), ‘Łutówka’ (B, E, H) i ‘Northstar’ (C, F, I): A–C – polar view, D–F – equatorial view, G–I – detail of the exine surface, massive striae are visible

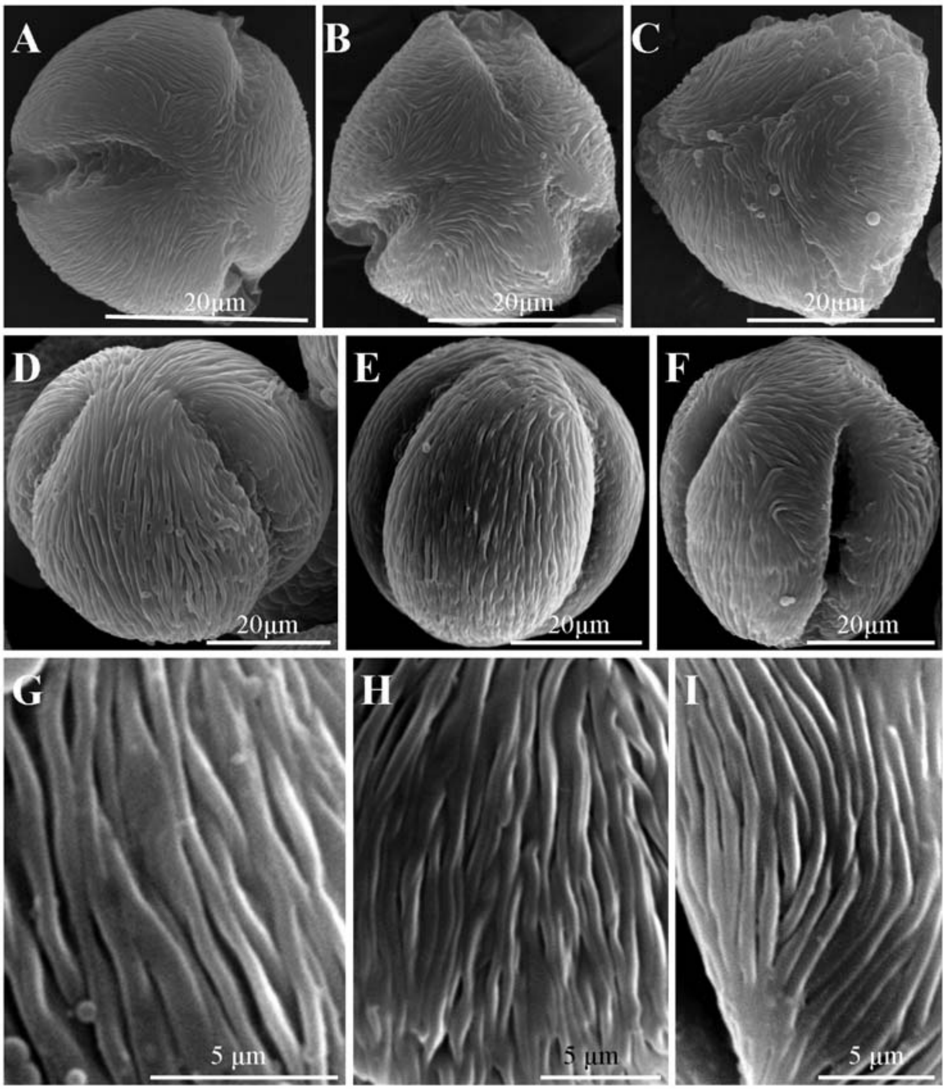

Fig. 4 A–I. Pollen grains of *P. cerasus* 'Kordia' (A, D, G), 'Regina' (B, E, H) i 'Vega' (C, F, I): A–C – polar view, D–F – equatorial view, G–I – detail of the exine surface, massive striae are visible

Perforations can be seen in the tectum of *P. armeniaca* (fig. 1 G–I)*, P. persica* (fig. 2 B, C, E, F), and *P. domestica* (fig. 5 I). The stria thickness differs significantly between cultivars within the species (except for *P. avium*). In turn, the groove width varies only between some taxa: *P. armeniaca*, *P. cerasus* and *P. avium* (tab. 2).

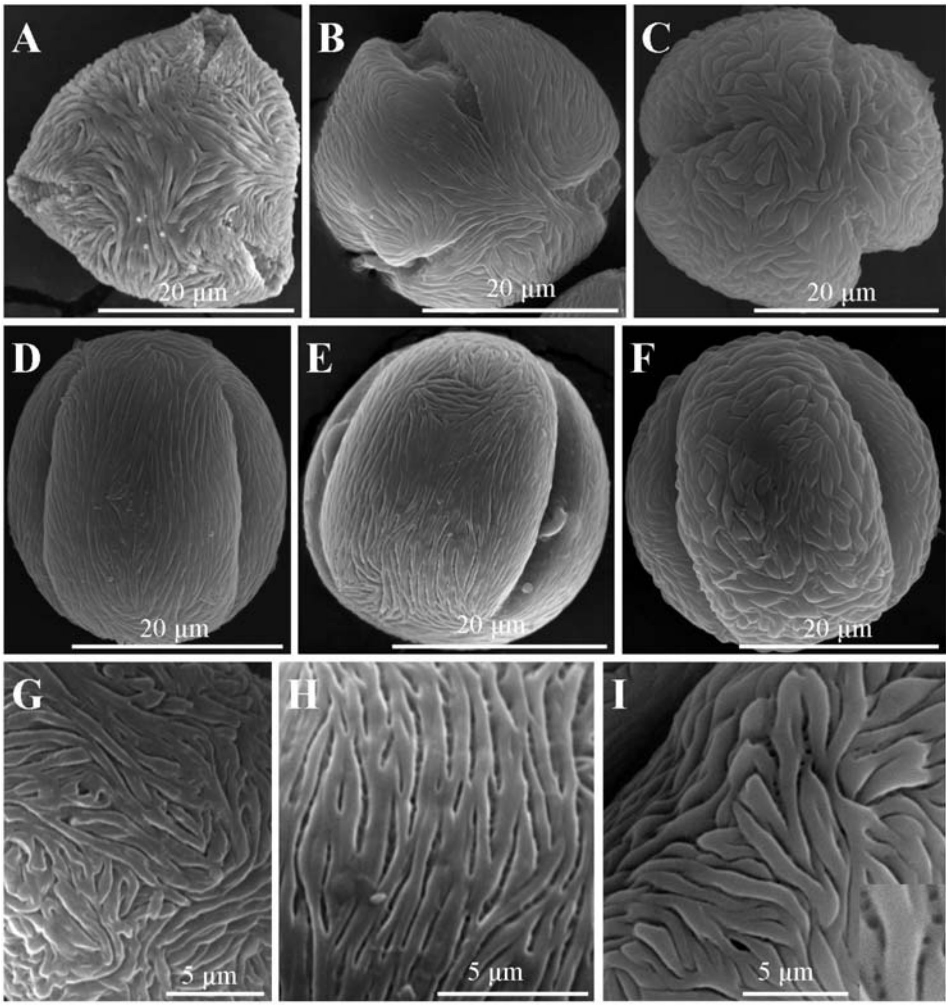

Fig. 5 A–I. Pollen grains of *P. domestica* 'Bluefre' (A, D, G), 'Cacanska Najbolja' (B, E, H) i 'Top' (C, F, I): A–C – polar view, D–F – equatorial view, G–I – detail of the exine surface, perforations and thick striae are visible (I)

DISCUSSION

Pollen grains of the studied species *P. armeniaca*, *P. persica*, *P. avium*, *P. cerasus* and *P. domestica* produce striate sculpture of the exine. In the *P. armeniaca* grains observed, the average length of the P (51 µm) and E (30 µm) axes is similar to the range of grain sizes in other apricot cultivars [Sótonyi et al. 2000, Geraci et al. 2012] and higher than the dimensions of pollen grains reported by Gilani et al. [2010]. The shape of the grains analyzed for this species was classified as prolate in our research, similarly to the literature reports [Fogle 1977, Dezhong et al. 1995, Sótonyi et al. 2000, Arzani et al. 2005, Geraci et al. 2012]. The perprolate shape has also been distinguished in pollen grains of other apricot taxa [Dezhong et al. 1995, Sótonyi et al. 2000, Arzani et al. 2005, Geraci et al. 2012]. The stria width in the sculpture of the investigated pollen grains of 'Harcot' (0.62 μm) and 'Wczesna z Morden' (0.43 μm) is in the range reported in the literature for various apricot cultivars [Sótonyi et al. 2000]. In 'Wczesna Orange' grains, the stria width (0.27 μm) was also found to be in agreement with the results of other authors [Dezhong et al. 1995, Arzani et al. 2005, Geraci et al. 2012], but it is also lower than the range given by Gilani et al. [2010]. Some authors report that a perforated tectum is found in *P. armeniaca* grains [Dezhong et al. 1995, Sótonyi et al. 2000, Arzani et al. 2005, You-chun et al. 2010, Geraci et al. 2012].

The dimensions of the investigated pollen grains (51/30 μm) and of those presented in the literature for various *P. persica* cultivars are similar [Radice and Galati 2003, Geraci et al. 2012]. In terms of shape, the pollen grains analyzed were classified as prolate, which is in agreement with the reports of the above-mentioned authors and Fogle [1977]. Grains with the perprolate shape have also been found in this species [Radice and Galati 2003, Gilani et al. 2010, Geraci et al. 2012]. The variation in the shape of grains may result from the varying degree of their hydration and a large proportion of sterile grains in the anthers of peach trees [Radice et al. 2004, Radice and Galati 2006]. The striae in the exine of the observed pollen grains of *P. persica* 'Redhaven' (0.60 μm) are thicker, while in 'Veecling' (0.31μm) thinner than the stria width in peach pollen presented by other authors [Gilani et al. 2010, Geraci et al. 2012]. In turn, the grooves in the exine ornamentation of the tested grains are twice narrower (0.17 μm) than the ones described by these researchers (0.32–0.43 μm). Perforations are found in the tectum of the grains analyzed in this study and of those presented in the literature [Geraci et al. 2012].

The length of the polar (44 μm) and equatorial (26 μm) axes of *P. avium* pollen grains studied is in the range reported for various cultivars of this species described in the literature [Kocoń and Muszyński 1982, Nyéki et al. 1996, Sótonyi et al. 2000, Geraci et al. 2012] and it is similar to the grain sizes determined by some other authors [Fogle 1977, Zander 1951], but higher than the values presented by Eide [1981]. In terms of shape, the sweet cherry pollen grains tested and those presented in the literature are classified as prolate [Fogle 1977, Sótonyi et al. 2000, Geraci et al. 2012]. The shapes of *P. avium* pollen grains have also been found to be prolate spheroidal [Gilani et al. 2010] and oblate spheroidal [Eide 1981, Gilani et al. 2010]. The stria width (0.65 μm) in the exine of the analyzed cultivars is similar to the values reported for these structures in the case of other sweet cherry taxa [Sótonyi et al. 2000] and twice higher than the width found by Gilani et al. [2010]. In turn, the groove width (0.17 μm) in the tested grains is lower than that given by these authors.

The dimensions of the P axis (37 μm) and E axis (29 μm) in *P. cerasus* pollen grains studied are consistent with the range of values given for these axes in other sour cherry cultivars [Zander 1951, Miaja et al. 2000]. However, the P axis in the grains observed is shorter than its dimensions presented by Kocoń and Muszyński [1982] as well as by

Sótonyi et al. [2000], while it is longer than the one calculated by Fogle [1977]. In terms of shape, the analyzed grains of 'Łutówka' and 'Northstar' were classified as subprolate. Prolate shaped grains [Fogle 1977, Nyéki et al. 1996, Miaja et al. 2000] as well as prolate spheroidal and perprolate shaped grains [Miaja et al. 2000] have been found in the pollen of other sour cherry cultivars. The width of striae (0.63 µm) and grooves (0.15 µm) in our study is in the range similar to that reported by Sótonyi et al. [2000]. According to Nyéki et al. [1996], the distance between striae varies. Sótonyi et al. [2000] explain that the pores can be covered by the striae. Their presence in the sculpture in sour cherry pollen grains was noticed by Geraci et al. [2012].

The dimensions of pollen grains (41/35 µm) in the studied *P. domestica* cultivars are in agreement with the sizes determined by other researchers [Zander 1951, Mitura 2002, Gilani et al. 2010, Geraci et al. 2012]. Pollen grains of 'Cacanska Najbolja' and 'Top' have a prolate spheroidal shape, while those of 'Bluefre' are subprolate; their shapes are consistent with the literature data [Hebda et al. 1991, Mitura 2002, Gilani et al. 2010, Geraci et al. 2012]. Oblate spheroidal pollen grains [Mitura 2002] and prolate grains [Fogle 1977, Sótonyi et al. 2000, Geraci et al. 2012] have also been distinguished in other plum taxa. The stria width in the sculpture of the tested grains of 'Bluefre' (0.86 µm) and 'Cacanska Najbolja' (0.68 µm) is in the range reported in the literature for plum pollen, while in the case of 'Top' (1.19 µm) it is higher compared to these values [Sótonyi et al. 2000, Gilani et al. 2010, Geraci et al. 2012]. The grooves in the ornamentation of the above-mentioned cultivars (0.24 µm) are narrower than those described by Gilani et al. [2010]. The tectum in the studied plum pollen grains and in those described for this species in the literature has a perforated surface [Hebda et al. 1991, Sótonyi et al. 2000, Geraci et al. 2012], while according to Micic et al. [1988] it has a continuous surface. The present study compared for the first time the micromorphology of the exine sculpture of fourteen tree species of the genus *Prunus* grown in Poland. Other authors have earlier published SEM data on the morphological characters of pollen grains of *P. cerasus* 'Łutówka', but without a detailed analysis of their exine sculpturing [Kocoń and Muszyński 1982]. The micromorphological characteristics of pollen grains described in this paper can be one of the features used for identification of some species of the genus *Prunus.*

CONCLUSIONS

1. The pollen grains of 14 varieties from the genus *Prunus* assessed in terms of their sizes were classified as medium or large. Their shape was defined as *prolatum*, *subprolatum*, or *prolato-spheroides.*

2. In a majority of the analysed cultivars, the striae in the exine sculpture differ significantly in their width, forming a characteristic pattern for each species: parallel, branched, or irregular.

3. The results of the investigations of the exine sculpture in pollen grains can be used in the taxonomy of species from the *Prunus* genus.

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MIKROMORFOLOGIA ZIAREN PYŁKU DRZEW OWOCOWYCH Z RODZAJU *Prunus*

Streszczenie. Mikromorfologiczna charakterystyka skulptury ziaren pyłku stanowi jedną z ważniejszych cech diagnostycznych roślin. Ziarna pyłku u różnych gatunków z podrodziny Prunoideae charakteryzuje zmienność co do wielkości, kształtu i skulptury egzyny. W prezentowanej pracy po raz pierwszy porównano mikromorfologię ziaren pyłku czternastu odmian w obrębie pięciu gatunków drzew owocowych z rodzaju *Prunus*. Obserwacje i badania morfometryczne ziaren pyłku wykonano przy użyciu mikroskopii świetlnej i skaningowej elektronowej. Badane ziarna pod względem wielkości zaliczono do średnich lub dużych. Ich kształt określono jako *prolatum*, *subprolatum* lub *prolato-spheroides*. Prążki w egzynie *P. armeniaca* przebiegają równolegle, mogą być rozgałęzione lub wygięte. Skulptura ziaren *P. persica* obejmuje prążki miejscami przebiegające równolegle lub nieregularnie, albo dychotomicznie rozgałęzione. W egzynie ziaren pyłku *P. avium* występują regularnie ułożone obok siebie lub miejscami rozgałęzione prążki. Rzeźba ziaren *P. cerasus* tworzy wydłużone prążki, niekiedy z delikatnym wygięciem lub z tendencją do przeplatania. Egzyna ziaren *P. domestica* charakteryzuje się rozwidlonymi, łukowato wygiętymi prążkami. Grubość *striae* istotnie różni się między odmianami w obrębie gatunków, a szerokość rowków tylko między niektórymi gatunkami i odmianami. Uzyskane wyniki badań związane ze skulpturą egzyny ziaren pyłku mogą być wykorzystane w taksonomii gatunków z rodzaju *Prunus*.

Słowa kluczowe: *Prunus,* ziarna pyłku, mikromorfologia, egzyna, skulptura, SEM

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