Journal of Applied Biological Sciences 6 (2): 13-18, 2012
ISSN: 1307-1130, E-ISSN: 2146-0108, www.nobel.gen.tr

Pollen Morphology of Exotic Trees and Shrubs of Edirne II

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Received: February 11, 2012
Accepted: Marh 10, 2012

Abstract

This study was undertaken to examine the pollen morphology of some of the exotic shrubs and trees found in the parks and the gardens of Edirne. In the present work five plant species were studied in this respect, namely: *Aesculus hippocastanum*, *Buddleia davidii*, *Crataegus oxycantha, Elaeagnus angustifolia* and *Philadelphus coronarius.* Pollen samples belonging to these species were examined with light photomicroscope as regards some morphological features, principally: pollen shape; size; aperture characters; sculpture and structure of the exine. Pollen grains of examined species were spheroidal in shape and most often tricolporate type. Exine layer of examined grains exhibited eutectate structure except the exine of the *Philadelphus coronarius* which exhibited semitectate structure. Exine ornemantation (Sculpture) of pollen grains had determined as striate in *Aesculus hippocastanum* , Rugulate- Perforate in *Buddleia davidii,* Striate - Perforate in *Crataegus oxycantha*, Psilate-verrucate in *Elaeagnus angustifolia* and reticulate in *Philadelphus coronarius*.

Key words: European Turkey, exotic plants, light microscope, pollen morphology

INTRODUCTION

Pollen grains found in high concentration in the atmosphere affect many people and cause allergic diseases. To take precaution against pollen allergies, it is necessary to know the type of the allergic pollens found in the atmosphere of the region and to determine their concentration in the different seasons [1]. Such kinds of data can be obtained only by preparing the pollen calender of the region [2]. In order to prepare the polen calender of the region, the vegetation and detailed pollen morphology of plants found in the region must be known very well [3].

Bıçakçı and et al. have analyzed the airborne pollen fall in Edirne [4]. They have identified the pollen grains found in the atmosphere and determined the changes in pollen fall per cm^2 weekly, monthly and annually. But they could not identify the pollen grains of some exotic plants found in the atmosphere. Because their morphology were not known. That's why pollen grains of these plants are missing in the pollen calendar of Edirne.

As mentioned above aeropalynology and many of the other palynological studies are based on the detailed knowledge of the pollen morphology. Since there is not enough data about the pollen morphology of exotic trees and shrubs in Edirne, we aimed to determine exotic trees and shrubs found in Edirne and examine the morphology of their pollen with successive studies. For this purpose, as a first part of this study we had studied the pollen morphology of *Tamarix parviflora*, *Campsis radicans, Prunus serrulata, Laburnum anagyroides* and *Lagerstroemia indica* [5]. In the present work, we have examined the pollen morphology of *Aesculus hippocastanum*, *Buddleia davidii*, *Crataegus oxycantha, Elaeagnus angustifolia* and *Philadelphus coronaries*. We hope this study will contribute to the preparation of pollen atlas of Edirne and it will also provide important contributions to the studies related to the treatment of allergic diseases.

MATERIAL AND METHODS

Plant specimens were collected and deposited in herbarium of Trakya University, Faculty of Science, Department of Biology (EDTU). For palynological studies newly blossomed flowers were fixed in acid-alcohol mixture (3:1) and stored in small bottles. In addition to this, some of the pollen samples were saved in the paper envelopes and labeled. Pollen grains were prepared for light microscopy by using Woodhouse's method [6]. Furthermore, some grains were treated with KOH for 5-10 minutes and then mounted in glycerine jelly which is stained with lactophenol-aniline blue [7]. Other samples were also mounted in glycerine jelly stained with basic fuchsine [8]. Pollen grains were examined morphologically with Olympus BH-2 light photomicroscope and measured under the microscope by using micrometric slides as regards following properties: polar length (P); equatorial diamater (E); length and wide of the colpi; diameter and length of pores and exine thickness. These measurements were based on 15-50 readings for each pollen sample. Data on size have been based on the measurement of 50 pollen grains. The mean value of the measurements (M) and standard deviation were calculated in computer by using SPSS 13.0 statistic program. Photomicrographs were taken with the same photomicroscope. The terminology used is in accordance with Erdtman [9,10] and Punt et al.[11].

RESULTS AND DISCUSSION

***Aesculus hippocastanum* L. (*Hippocastanaceae*)**

Origin of sample: Edirne – Turkey**.**

Pollen Grain Characteristics (Figs 1a-1e)

Pollen Type: Tricolporate

Pollen Shape: Spheroidal, P/E = 1.1 µm

Exine: Average thickness is 1,2 µm. It is thicker around the colpi.

Intine: Thin. Average thickness = 0.6 µm, Ex/int = 2/1.

Aperture: Colpi are long and broad with tapering ends, border of colpus is well-defined. Colpus membrane is granulate. Pori are very clear. Porus has spinous operculum. Diameter of the operculum is 0.5-2 µm, its length is 0.9 µm.

Tectum: Tectate

Sculpture (Ornamentation): Striate. Thin and regular striation between colpi and irregular at poles.

P : 23.4 µm ± 1.25 µm.; **E:** 21.2 µm ± 2.98 µm.

Clg : 21.4 µm ± 1.4 µm**.; Clt** : 9.43µm ± 1.8 µm.; **Plg** : 6.35 µm ± 0.5 µm**.; Plt** : 7.29 µm ± 0.4 µm.

Aesculus hippocastanum has been studied by Aytuğ [12] and Pehlivan [13] with light microscopy. In these studies the pollen samples have been taken around Istanbul. In addition to this *Aesculus hippocastanum* have also been studied with SEM by Halbritter [14]. Results of these three studies are similar to the results of our study. In all of these studies the pollen grains are spheroidal and tricolporate, tectum layer is eutectate and ornamentation is striate.

***Buddleia davidii* Franch. (*Buddlejaceae*)**

Origin of sample: Karaağaç – Edirne-Turkey.

Pollen Grain Characteristics (Figs 2a-2f)

Pollen Type: Tricolporate. Afew of pollen grains are tetracolporate and pentacolporate.

Pollen Shape: Spheroidal, P/E = 0.97

Exine: Average thickness - 1.42 µm.

Intine: Thin; Ex/Int = 3/1.

Apertures: Colpi are long and narrow with tapering ends. Borders of colpi are well defined. Pori are very clear and situated at the midpoint of colpus. Plg/Plt =0.62. There is a 0.36 µm wide annulus around each pore.

Tectum: Eutectate; Ect = End

Sculpture (Ornamentation): Rugulate- Perforate.

P (Polar axis): 14.66 µm ± 1.62 µm.; **E (Equatorial axis):** 15.12 µm ± 0.94 µm.

Clg : 12.12µm. **Clt:** 2.68 ± 0.86 µm.; **Plg:** 1.67 µm ± 0.59 µm.;**Plt**:2.68 ± 0.44

We could not find any literature about *Buddleia davidii* . But from the same genus *B. alternifolia* has been studied with SEM by Halbritter & Webber [15]. Although they are different species, their pollen morphology are similar to each other in some characteristics. In the two *Buddleia* species, the pollen grains are spheroidal and 3-colporate. Structure of tectum is eutectate. In our study we interpreted the ornamentation of pollen of *Buddleia davidii* as rugulate – perforate, whereas in the study of Halbritter & Weber [15], the ornamentation of *Buddleja alternifolia* has shown as perforate.

Crataegus oxycantha* L. *(Rosaceae)

Origin of sample: Edirne- Turkey.

Pollen Grain Characteristics (Figs 3a- 3d).

Pollen Type : Tricolporate.

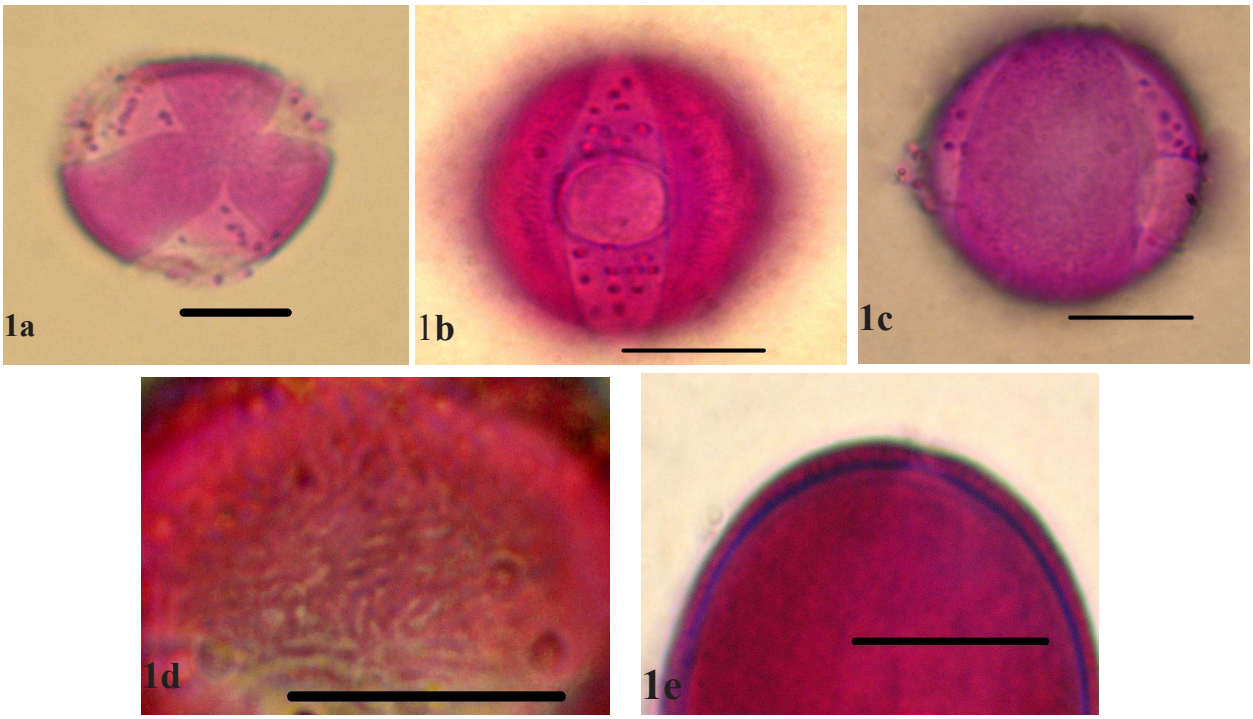
Pollen Shape: Spheroidal, P/E = 1.06.

Exine: Average thickness : 1.17 µm.

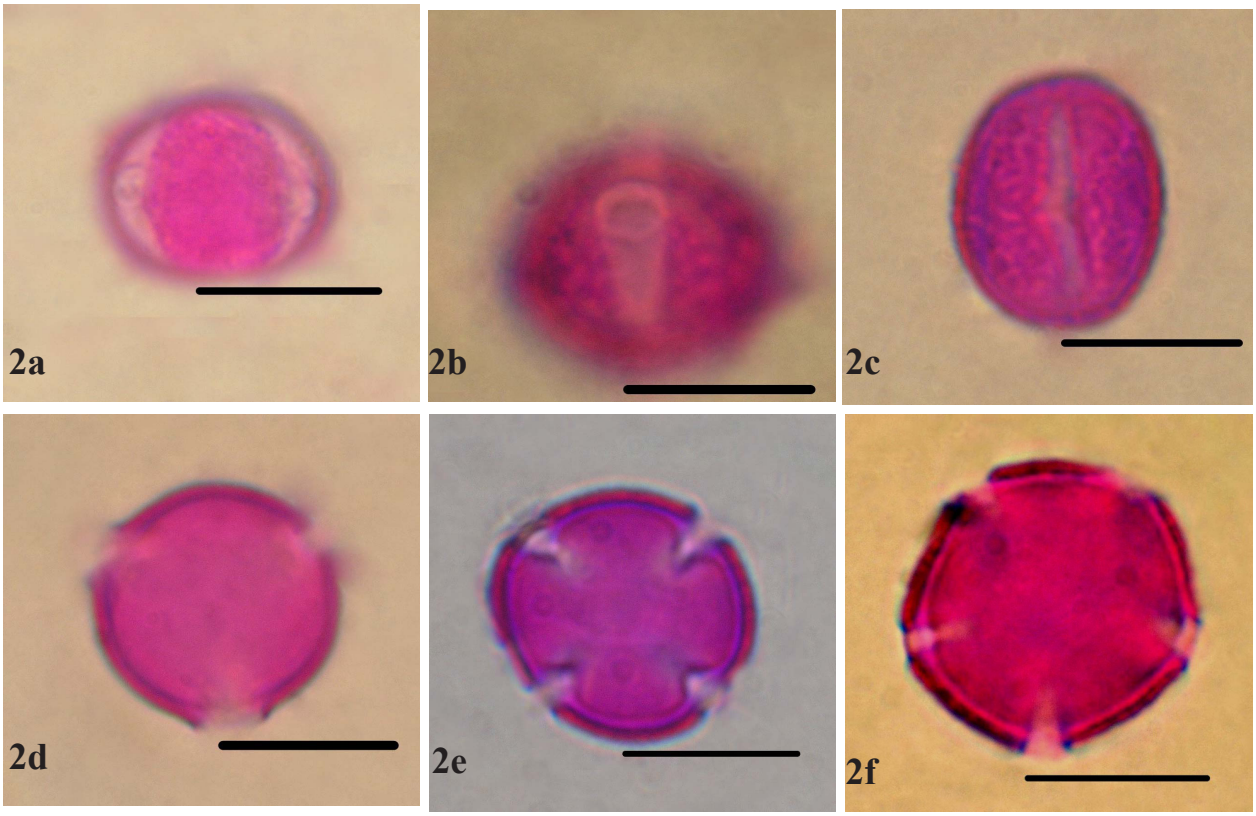
Intine: Thin. It is not uniform. Its thickness changes. Ex/in = 5/1.

Apertures : Furrows are long and narrow with lightly tapering to rounded ends. Border of colpus is not well defined. Pori are not clear and can not be identified easily.

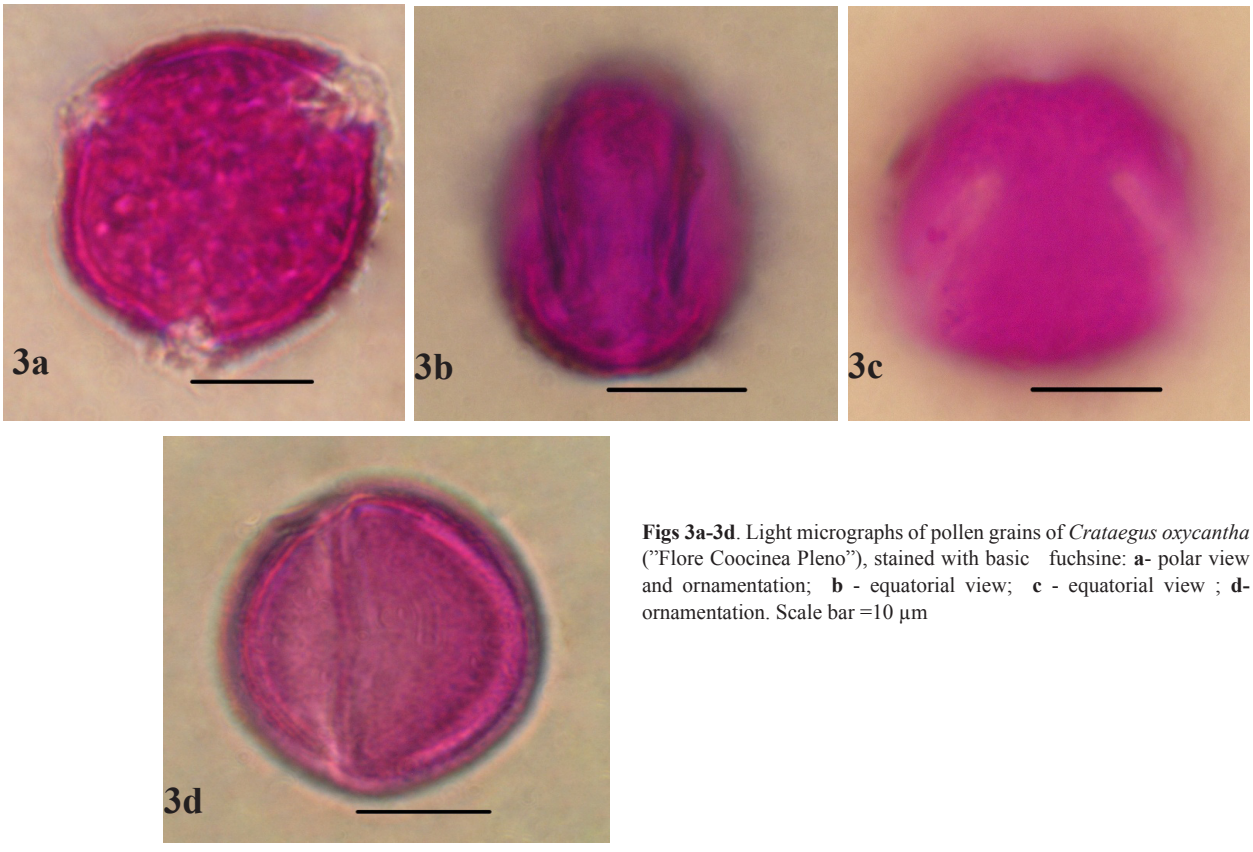
Tectum: Eutectate. Ect/End = 4/1.



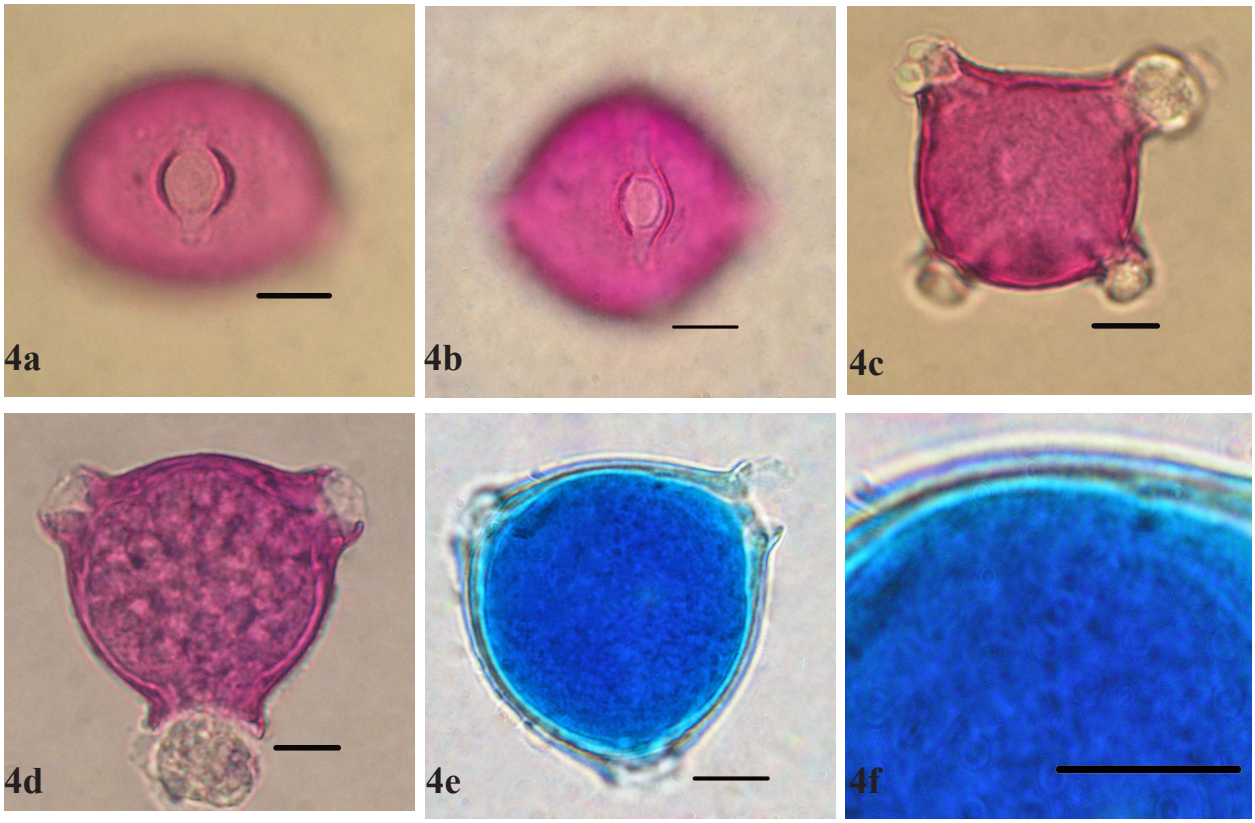
Figs 1a-1e. Light micrographs of pollen grains of *Aesculus hippocastanum* stained with basic fuchsine: **a-** polar view; **b-** detail of aperture; **c -** equatorial view; **d -** ornamentation. **e-** exine layer (stained with orcein) Scale bar =.10µm



Figs 2a-2f. Light micrographs of pollen grains of *Buddleia davidii*, stained with basic fuchsine: **a -** equatorial view; **b -** detail of aperture; **c-** aperture and ornamentation; **d-** polar view, **e-** polar view of tetracolporate pollen (stained with orcein) ; **f-** polar view of pentacolporate pollen. Scale bar =10 µm



Figs 3a-3d. Light micrographs of pollen grains of *Crataegus oxycantha* ("Flore Coocinea Pleno"), stained with basic fuchsine: **a-** polar view and ornamentation; **b** - equatorial view; **c** - equatorial view ; **d-** ornamentation. Scale bar =10 µm



Figs 4a-4f. Light micrographs of pollen grains of *Elaeagnus angustifolia.* Figs 4a-4d**.** stained with basic fuchsine: **a-** detail of aperture; **b** - Equotorial view and detail of aperture; **c -** polar view; **d** - polar view and ornamentation, **e-** polar view of pollen grain stained with lactophenol aniline blue**, f-**view of the pollen wall stained with lactophenol-aniline blue. Scale bar =10 µm

Sculpture (Ornamentation): Striate - Perforate. Thin, and irregular striation**.** That's why it has granular appearance.

P: 29.81 µm ± 1.57 µm.; **E :** 28.09 µm±1.91 µm.

Clg :24.15 µm. **Clt:** 4.5 µm.; **Plg** and **Plt:** They could not be measured.

Pollen morphology of European Crataegus species have been examined by several workers (Reitsma [16] 1966 ; Byatt 1976 [17]; Eide 1981 [18]; Moore et al. [19] 1991, Bombosi; [20] 2000), while that of some species from North America was studied by Dickinson and Phipps [21] (1986) and Hebda et al. [22], Zhou et al.[23].

From Turkish Crataegus species, Pollen morphology of ***Crataegus oxycantha* L.** has not been examined. But pollen morphology of *Crataegus monogyna* has been studied by Aytuğ et al. [12] and Pehlivan [13] . In addition to these Dönmez [24] has studied the pollen morphology of 20 Turkish Crataegus L. Taxa using light and scanning electron microscopy to determine whether pollen traits are of taxonomic value in this species group. The results of our study is consistent with the results of pollen morphological investigation of other Crataegus species.

Elaeagnus angustifolia* L. *(Elaeagnaceae)

Origin of sample: Edirne- Turkey.

Pollen Grain Characteristics (Figs 4a-4f)

Pollen Type: Tricolporate. A few of pollen grains are tetracolporate.

Pollen Shape: Spheroidal, P/E = 0.91

Exine: Average thickness is 1.6 µm.

Intine: 0.96 µm

Apertures: Furrows are short and broad with lightly tapering ends. There is edging in the ectexine around the furrows forming margo. Pori are well-defined and situated at the midpoint of colpus. plg / plt = 1.3. There is an operculum on the border of each pore.

Tectum: Eutectate.

Sculpture (Ornamentation): Psilate-verrucate

P : 34.60 µm ± 2.69 µm.; **E :** 37.73 µm ± 1.53 µm.

Clg: 19.1 µm. **Clt:**5.79. **; Plg:** 6.53 µm. **Plt:** 5 µm

Elaeagnus angustifolia pollen has been studied before with SEM by Halbritter [27]. Our results are similar to his data on this species, excepting the type of pollen. In our study we observed the well bordered pores and thus we described the pollen grains as a 3-colporate, whereas Halbritter [27] has been described pollen as 3 colpate.

Philadelphus coronarius* L. *(Saxıfragaceae)

Origin of sample: Edirne-Turkey.

Pollen Grain Characteristics (Figs 5a-5g)

Pollen Type: Tricolporate.

Pollen Shape: Spheroidal, P/E =1.01.

Exine + Intin: Average thickness: 1.41 µm.

Intine: Thin. Ex/Int = 3/1.

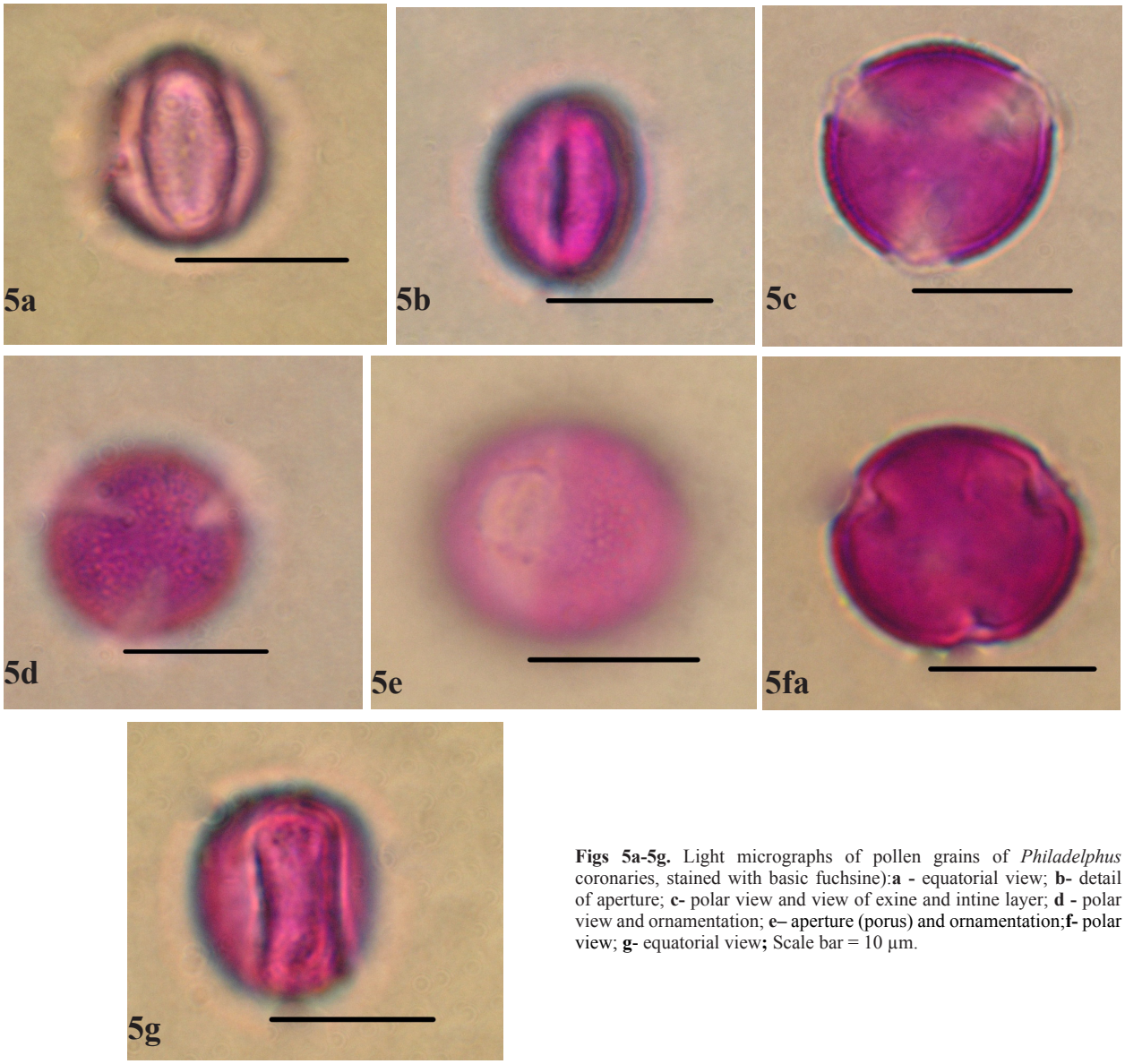
Apertures: Furrows are long and narrow; their end is not pointed; border of colpus is clear.

Tectum: Semitectate. Ect /End = 3

Sculpture (Ornamentation): Reticulate.

P: 15.64 µm ± 1.29 µm.; **E:** 15.46 µm ± 1.34 µm.

Clg : 11.9 µm ± 2.3 µm.; **Clt:** 2.82 µm ± 0.4 µm.; **Plg:** 2.82 µm.; **Plt:** 2.82µm.



Figs 5a-5g. Light micrographs of pollen grains of *Philadelphus* coronaries, stained with basic fuchsine):**a -** equatorial view; **b-** detail of aperture; **c-** polar view and view of exine and intine layer; **d -** polar view and ornamentation; **e–** aperture (porus) and ornamentation;**f-** polar view; **g-** equatorial view**;** Scale bar = 10 µm.

We could not find any literature about *Philadelphus coronarius* .

Abbreviations

Clg: Colpus length; Clt: Colpus wide; E: Equatorial axis; Ect: Ectexine; End: Endexine; Ex: Exine; Int: Intine; P: Polar axis Plg: Porus length; Plt: Porus wide

Acknowledgement

We would like to thank in advance the Scientific Research Fund of Trakya University which supported financially this study (Project No: TUBAP-661). The authors are grateful to Prof . Dr. Burhan Aytuğ for his kind assistance. The authors are also thank to the Dr. Güler Dalgıç for her help in determination of the plants.

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