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Pollen morphology of some *Allium* L. taxa (sect. Codonoprasum/Alliaceae) in Turkey

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Abstract: The genus *Allium* L. is represented by about 196 taxa grouped under 14 sections in Turkey. The sect. *Codonoprasum* consists of 49, of which 21 are endemics. In this study pollen morphological features of 12 taxa belonging to Sect. *Codonoprasum* have been demonstrated using Wodehouse (1935) method and with Light Microscope (LM). Detailed pollen morphological characteristics of genus *Allium* are given on the basis of the results presented. The genus *Allium* is homogeneous in both aperture type and exine ornamentation. The pollen of the genus is monocolpate. The shapes (based on Long Axis / Short Axis) are prolate and subprolate. The colpus extends from distal to proximal side in all taxa. The colpus membrane is provided with a fragmented operculum in the sect. *Codonoprasum*.

Key words: *Allium, Codonoprasum*, pollen, Wodehouse, Turkey

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Introduction

According to up dated knowledge, in Turkey the genus *Allium* is represented by 196 taxa (1). The section *Codonoprasum* is one of the most complicated sections in the genus. This section is clearly recognizable by the presence of two long unequal spathe valves and is taxonomically related to *Allium* sections *Scorodon* and *Brevispathe*. The Sect. *Codonoprasum* includes 49 taxa of which 21 are endemics.

The genus *Allium* pollen is important as food for *Apis mellifera.* Honey bee collects a large number of *Allium* pollen, because; inflorescence of *Allium* species have many flowers, so when honey bees visit an individual, they could reach many flowers and many pollen grains, also honey bees can take both pollen grains and nectar. So, the genus *Allium* is one of the important honey plants (2).

The sect. *Codonoprasum* was investigated palynologically by several researchers (3, 4). The present study is pollen grain examination of 12 taxa, of which 2 are new species for science and 2 new records for Turkey (5, 6).

Material and methods

The investigated specimens of 12 *Allium* taxa collected from Turkey during the field studies of the thesis entitled "Taxonomical investigation of the genus *Allium* L., the sect. *Codonoprasum* in Turkey" by the first author (Mine Koçyiğit) under guidance of advisor Prof. Dr. Neriman Özhatay. Pollen samples were taken from the herbarium specimens in ISTE (Herbarium of the Faculty of Pharmacy of Istanbul University). The pollen preparations were done using the methods of Wodehouse (7). The slides were observed using Olympus BH-2 light microscope with x100 objective and analyzed by Spot Advanced Software 4.1. The terminology is according to Moore and Webb (8).

Results and discussion

The investigated specimens, ISTE voucher numbers and localities were listed in Table 1. Also the main palynological features of the investigated *Allium* taxa are summarized in Table 2. According to LM investigations, the pollen grains are monocolpate. The pollen shape (based on LA/SA ratio) is mostly prolate, only three taxa (*A. dentiferum*, *A. flavum* subsp. *flavum* var. *minus*, *A. maraschicum*) are subprolate in distal view (Figures 1, 2), and all taxa are circular in polar view. The colpus extends from distal to proximal in all species. Colpus ends are rounded the results support previous studies (4). As a rule, the colpus becomes narrow at the equator and widens at the poles. The exine structure is tectate in all examined taxa, the sculpture is shadowy regulate in *A. dentiferum*, *A. dodecanesii* and *A. stamineum*, on the other hand the rest of the examined taxa are psilate (Figure 3). The smallest grains (*A. maraschicum*) have a long axis of 33.22 μm and a short axis of 25.31 μm. The largest (*A. pictistamineum*) have a long axis of 43.12 μm and a short axis of 26.21 μm. Exine was the thickest in *A. maraschicum* and thinnest in *A. dentiferum*.

The common characteristics of the genus *Allium* pollens have been investigated. Species show that their pollen apertures are monocolpate and monocolpate-operculate. We have found that the *Allium* pollen is monocolpate and colpus extends from distal to proximal. These results are similar to former studies (9, 10, 11).

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Table 1: List of voucher specimens and localities belonging to the investigated *Allium* taxa

Taxa	**ISTE voucher numbers**	**Localities**
A.charaulicum Fomin	87804	**Ardahan:** Göle yolu, 1989 m, *M. Koçyiğit*, 16 vııı 2009
A. dentiferum Webb & Berthel.	86053	**Antalya:** Side, 9 m, *M. Koçyiğit & T. Gün*, 20 vı 2008
A.dodecanesii Karavokyrou & Tzanoud.	86054	**İçel:** Mersin, Kuzucubelen, 671 m, *M. Koçyiğit*, 18 vı 2008
A.flavum L. subsp. *flavum* var. *minus* Boiss.	87644	**Bursa:** Uludağ yolu, kayalıklar, 1808 m, *M. Koçyiğit*, 16 vıı 2008
A.flavum L. subsp.*tauricum* (Besser ex Reichb.) Stearn var. *pilosum* Kollmann & Koyuncu	87777	**Gaziantep**: Fevzipaşa'dan Hasanbeyli'ye giderken, soldaki kayalıklar, 873 m, *M. Koçyiğit,* 14 vıı 2009
Allium marashicum M. Koçyiğit & N.Özhatay	86 113	**Kahramanmaraş**: Ahırdağı, 1800 m, M. Koçyiğit, 15 vıı 2009 **(type)**
Allium pictistamineum O. Schwarz	87737	**Manisa:** Spil dağı, Atalanı, 1300 m, *M. Koçyiğit*, 21 vı 2009
Allium pseudoflavum Vved.	87778	**Kahramanmaraş:** Ahırdağı, 1204 m, *M. Koçyiğit*, 15 vıı 2009
Allium retrorsum (Özhatay & Kollmann) Brullo, Guglielmo, Pavone & Salmeri	35799	**İçel**: Bolkar Dağları, Arslanköy, Boğazağzı, 1750 m, K. Alpinar, 6 vııı 1976 (**type**)
Allium rumelicum M. Koçyiğit & N. Özhatay	86112	**Kırklareli**: Demirköy, Dupnisa Cave, E. Akalın, Y.Yeşil, U. Uruşak, 27 vıı 2009 **(type)**
Allium stamineum Boiss.	87749	**Isparta:** to Eğirdir from Karadiken village, 964 m, *M. Koçyiğit*, 27 vı 2009
A.turcicum N. Özhatay & Cowley	87038	**Adıyaman**: Uzunköy–Çamyurdu arası, 1111 m, *M. Koçyiğit*, 23 v 2008

Table 2: General characteristics of the investigated *Allium* taxa

TTaxa	PPollen Shape ((L/S)	L Long axis (µm)	L Short axis (µm)	Clg (µm)	Clt (µm)	Exine (µm)	I Intine (µm)	Ex/In	Structure	Sculpture
A.charaulicum	Prolate (1,42)	39,25 ±1,30	27,59 ±1,65	28,04 ±0,61	4,70 ±0,76	1,65 ±1,6	1 ±0	1,65	Tectate	Psilate
A. dentiferum	Sub-prolate (1,28)	37,31 ±1,37	29,11 ±1,73	26,87 ±1,67	5,58 ±1,53	1,2 ±0,71	1,13 ±0,33	1,06	Tectate	Rugulate
A.dodecanesii	Prolate (1,61)	41,68 ±1,20	25,93 ±0,45	24,86 ±2,31	2,71 ±1,36	1,36 ±1,67	1,2 ±0,6	1,13	Tectate	Rugulate
A.flavum subsp. *flavum* var. *minus*	Prolate (1,38)	41,91 ±0,83	30,35 ±1,68	28,26 ±0,63	4 ±0,84	1,67 ±1,1	1 ±0	1,67	Tectate	Psilate
A.flavum subsp. *tauricum* var. *pilosum*	Prolate (1,43)	35,74 ±0,99	25,059 ±0,54	21,23 ±1,74	2,75 ±0,75	1,27 ±0,86	1,25 ±0,83	1,02	Tectate	Psilate
A.maraschicum	Sub-prolate (1,32)	33,22 ±1,64	25,31 ±0,91	19,07 ±0,74	3,36 ±1,39	2 ±0	1,25 ±0,97	1,6	Tectate	Psilate
A.pictistamineum	Prolate (1,65)	43,12 ±1,90	26,21 ±0,867	25,29 ±1,66	4,11 ±0,35	1,69 ±1,85	1,13 ±0,5	1,50	Tectate	Psilate
A.pseudoflavum	Prolate (1,38)	35,2 ±0,37	25,44 ±1,06	24 ±0,97	4±0	1,58 ±1,5	1±0	1,58	Tectate	Psilate
A.retrorsum	Prolate (1,46)	38,75 ±1,23	26,57 ±1,22	31,82 ±0,92	4,43 ±1,7	1,67 ±1,56	1 ±0	1,67	Tectate	Psilate
A.rumelicum	Prolate (1,41)	34,06 ±2,17	24,11 ±0,83	25,43 ±1,7	2,83 ±1,39	1,92 ±0,47	1,13 ±0,46	1,70	Tectate	Psilate
A.stamineum	Prolate (1,61)	39,2 ±0,57	24,03 ±0,33	26,4 ±1,24	4,55 ±1,47	1,73 ±0,86	1 ±0	1,73	Tectate	Rugulate
A.turcicum	Prolate (1,56)	39,06 ±2,17	25,11 ±0,83	24,43 ±1,7	2,79 ±1,39	1,96 ±0,47	1,11 ±0,46	1,77	Tectate	Psilate

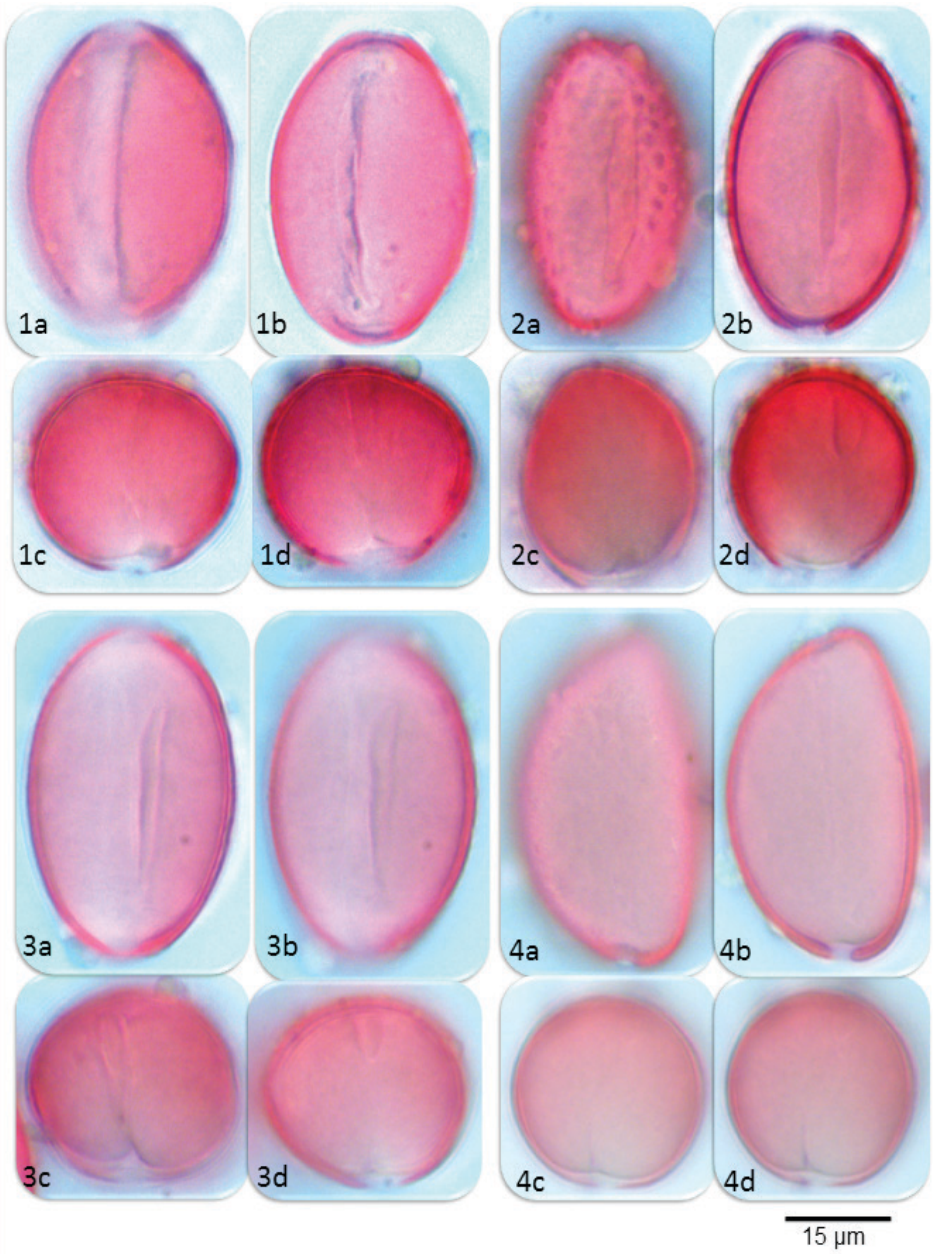

Figure 1: Light microscopy images for *Allium* pollens: a) Ornamentation and colpus, equatorial view, b) Optical section, equatorial view, c) Ornamentation, polar view, d) Optical section, polar view. 1) *A.charaulicum*, 2) *A. dentiferum*, 3) *A.dodecanesii*, 4) *A.flavum* subsp. *flavum* var. *minus*.

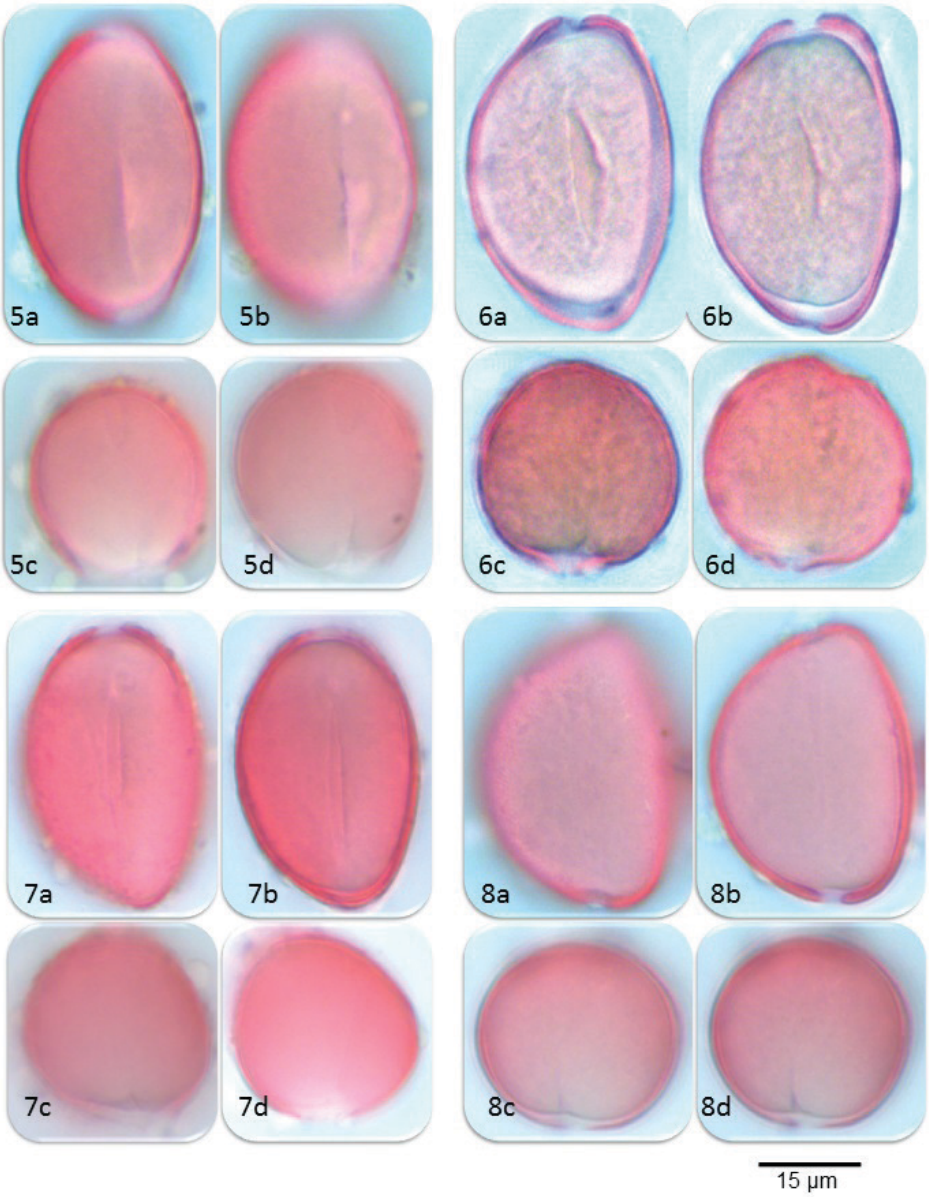

Figure 2: Light microscopy images for *Allium* pollens: a) Ornamentation and colpus, equatorial view, b) Optical section, equatorial view, c) Ornamentation, polar view, d) Optical section, polar view. 5) *A.flavum* subsp. *tauricum* var. *pilosum*, 6) *A.maraschicum*, 7) *A.pictistamineum*, 8) *A.pseudoflavum*.

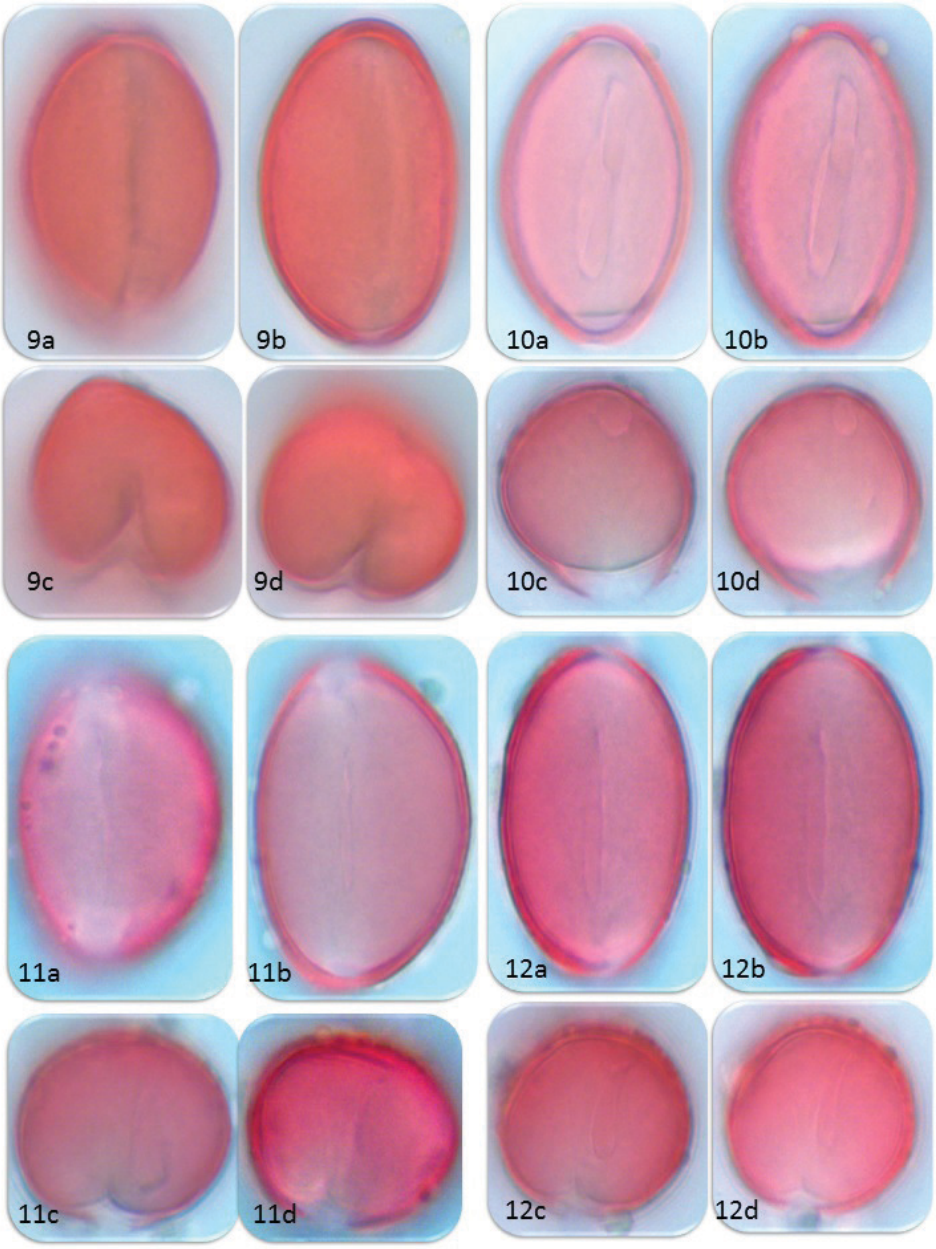

Figure 3: Light microscopy images for *Allium* pollens: a) Ornamentation and colpus, equatorial view, b) Optical section, equatorial view, c) Ornamentation, polar view, d) Optical section, polar view. 9) *A.retrorsum*, 10) *A.rumelicum*, 11) *A.stamineum*, 12) *A.turcicum*.