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CHECK-LIST OF THE GENUS *ALLIUM* IN ŞANLIURFA (TURKEY) AND CONTRIBUTIONS TO THE MORPHOLOGY OF LOCAL ENDEMIC *ALLIUM EKERI* AND *ALLIUM VARIEGATUM*

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ABSTRACT

The aim of this study is to determine the current number of *Allium* species in Şanlıurfa and to contribute to the morphology of local endemic *Allium ekeri* and *Allium variegatum*. According to the Flora of Turkey, there are 5 *Allium* taxa in Şanlıurfa. As a result of floristic studies carried out after the 2000s, the number of *Allium* in Şanlıurfa increased to 28. In this study, the current species list of *Allium* species distributed in Şanlıurfa is given. Morphological measurements of local endemic *Allium ekeri* and *Allium variegatum* collected from the study area were made and their detailed description, habitat and IUCN threat categories were given.

Introduction

With about more than 1000 species, *Allium* is the largest genera of monocotyledons in the Amaryllidaceae and it has been divided into 15 subgenera and 72 sections (Friesen *et al*. 2006, POWO 2023), however some of the subgenera may not be monophyletic (Li *et al.* 2010).

The northern hemisphere is the region with the highest species diversity of the *Allium* genus, especially the region from the Mediterranean basin to Central Asia and Pakistan (Şekil 1). The region with the second most species diversity is the western part of North America. Only one species (*A.*

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dregeanum) is found in the southern hemisphere (Block 2010, Fritsch and Friesen 2002).

Turkey is one of the important countries of *Allium* diversity worldwide. It is one of the largest genus in Turkey. In recent years, many new *Allium* have been described from Turkey (Armağan 2021a, 2021b, Balos *et al.* 2021, Balos 2022a, 2022b, 2022c, Balos *et al*. 2022, Balos *et al*. 2023, Balos and Geçit 2023a, Balos and Geçit 2023b, Brullo and Salmeri 2021, Eker 2023, Fırat 2023, Koçyiğit *et al*. 2023a, Koçyiğit *et al*. 2023b, Özdöl *et al*. 2022, Pirhan 2022).

According to the World Checklist of Vascular Plants (POWO 2023), *Allium* is represented in Turkey by 222 taxa, 109 of which are endemic. This number becomes 231 (118 of which are endemic), including 9 taxa (Balos 2022a, 2022b, Balos *et al*. 2023a, Balos and Geçit 2023, Eker 2023, Özdöl *et al*. 2022, Koçyiğit *et al*. 2023a, Koçyiğit *et al*. 2023b, Fırat 2023) that were recently described and are not recorded in the POWO database.

Şanlıurfa province is also a region rich in *Allium*. According to Flora of Turkey (Kollmann, 1984), there are 5 *Allium* taxa in Şanlıurfa. Eker *et al*. (2008) reported 17 *Allium* species in Şanlıurfa. Eker *et al*. (2011), Koçyiğit *et al*. (2014) and Balos (2022a, 2022b, 2022c), the number of species increased to 23. In this study, the current number of species in Şanlıurfa is reported as 28. There are 36 *Allium* species in Tunceli (Armağan 2018), 27 in Mardin (Balos *et al*. 2023b), 13 in Batman (Fidan *et al*., 2019), 11 in Bingöl (Pınar *et al*. 2018), and 11 in Siirt (Pınar *et al*. 2019).

Material and Methods

The research material consists of *Allium* species in Şanlıurfa. In order to determine the Allium list in Şanlıurfa, many studies were reviewed, especially the Flora of Turkey (Kollmann 1984), the geophyte flora of Şanlıurfa (Eker *et al*., 2008) and other floristic study of Şanlıurfa (Akan *et al*. 2005a, 2005b, Balos 2023, Balos & Akan 2008, Kaya & Karataş 2019, Korkut *et al*, 2008). In addition, the taxa identified during field studies were added and the list was finalized. Detailed morphological measurements, descriptions of the species, habitat, green areas and IUCN categories of the local endemic *Allium ekeri* E.Kaya & Koçyiğit and *Allium variegatum* Boiss. species are given. Additionally, the findings were compared with Flora of Turkey.

Result and Discussion

A total of 28 taxa, 8 of which are endemic, were identified throughout Şanlıurfa province (Table 1.) *Allium chloranthum, A. flavum subsp. tauricum* var. *pilosum, A. pseudoflavum, A. wendelboanum* taxa were identified as new records for Şanlıurfa flora. In terms of phytogeographic regions, 19 are Iran-Turan, 8 are Mediterranean and 1 is widely distributed. Taxa are given in alphabetical list.

List of taxa distributed in Şanlıurfa

1. *Allium ampeloprasum* L. Sp. Pl.: 294 (1753)
2. *Allium asclepiadeum* Bornm. Notizbl. Bot. Gart. Berlin-Dahlem 7: 42 (1917)
3. *Allium callidyction* C.A.Mey. ex Kunth. Enum. Pl. 4: 413 (1843)
4. *Allium calyptratum* Boiss. Diagn. Pl. Orient. 13: 30 (1854)
5. *Allium cardiostemon* Fisch. & C.A. Mey. Ind. Sem. Horti Petrop. 6: 43 (1840)
6. *Allium chloranthum* Boiss. Diagn. Pl. Orient. ser. 1(13):33 (1853)
7. *Allium chrysantherum* Boiss. & Reut, P.E.Boissier, Fl. Orient. 5: 280 (1882)
8. *Allium deneliae* Balos, Ann. Bot. Fenn., 59(1):213-218 (2022), **Endemic**

9. *Allium dictyoprasum* C.A. Mey. ex Kunth, Enum. Pl. 4: 390 (1843)
10. *Allium ekeri* E.Kaya & Koçyiğit, Türk. Geofitleri 3: 516 (2014). **Endemic**
11. *Allium tauricum var. pilosum* (Kollmann & Koyuncu) Koçyiğit & Özhatay ex Idrees & J.M.H.Shaw, Phytotaxa 566(1): 141 (2022). **Endemic**
12. *Allium tauricum* (Besser ex Rchb.) Grossh., Fl. Kavkaza [Grossheim] 1: 213 (1928).
13. *Allium halfetiense* Balos, Ann. Bot. Fenn., 59(1): 274 (2022). **Endemic**
14. *Allium halfetiense* var. *cecenii* Balos, Ann. Bot. Fenn., 59(1): 276 (2022). **Endemic**
15. *Allium kharputense* Freyn & Sint. Öst. Bot. Zeitschr. 42: 378 (1892).
16. *Allium nigrum* L. Sp. Pl. ed. 2: 430 (1762).
17. *Allium noëanum* Reuter ex Regel, All. Monogr. 235 (1875).
18. *Allium olivieri* Boiss. Fl. Orient. 5: 284 (1882)
19. *Allium orientale* Boiss. Diagn. Ser. 1(13): 25 (1854).
20. *Allium pallens* L. Sp. Pl. ed. 2: 427 (1762)
21. *Allium pseudoflavum* Vved. Byull. Sredne-Aziatsk. Gosud. Univ. 19: 123 (1934)
22. *Allium rotundum* L. Sp. Pl. ed. 2: 423 (1762)
23. *Allium schergianum Boiss*., Fl. Or. 5: 251 (1882).
24. *Allium stamineum* Boiss., Diagn. Ser. 2 (4): 119 (1859).
25. *Allium sultanae-ferhanii* Balos, Ann. Bot. Fenn. 59(1):185-189 (2022). **Endemic**
26. *Allium trachycoleum* Wendelbo, Bot. Not. 122: 35 (1969)
27. *Allium variegatum* Boiss. Diagn. ser. 1 (7): 118 (1846). **Endemic**
28. *Allium wendelboanum* Kollmann, Notes Roy. Bot. Gard. Edinburgh 41: 267 (1983). **Endemic**

Examined examples:

Allium variegatum Boiss.
Turkey, Şanlıurfa, Siverek, Karacadağ, Rame stream, among large basalt rocks, 1430 m a.s.l., 21 May 2021, M. Balos 5214.
Allium ekeri E.Kaya & Koçyiğit
Turkey, Şanlıurfa Province, Mt. Tek Tek, near Çatallı village, upper irrigation canal, stony hill slopes, stony steppes, 480-510 m a.s.l., 25 May 2022 M. Balos 5335.

Contributions to *Allium variegatum* morphology

***Allium variegatum* Boiss., Diagn. ser. 1(7): 118 (1846).**

Type: Turkey, Diyarbakir/Mardin: inter Diarbekir et Mardin Assyriae, 1841, Kotschy 305, (holo. G iso. K).
Description: Bulbous perennial, bulb ovoid, 1-2.5 × 1.5-3 cm, 1-3 white bulblets; outer tunics grey-black papery, forming collar on stem; inner tunics white, membranous, usually a single scapus emerges from a bulb. Scape 50-70 cm, cylindrical, glabrous, no waxy layer, up to 1/2-1/3 length covered by scabrite sheaths. Leaves 3, filiform, cylindrical, hollow, 1-1.5 mm in diameter, 15-25 cm long, shorter than the scapus. Spata, with 2 unequal valves, permanent, longer than the umbella, broad base, ovate, narrowing suddenly towards the tip, mostly with 5-6 nerved, longer one 2.5-3.5 cm, shorter one 2-2.5 cm. Umbella spherical, 1.5-2.5 cm in diameter, very dense, with 50-100 flowers; pedicels unequal, 1-1.5 cm, glabrous, yellowish-green below, upper part purple. Perigon goblet-shaped, greenish-purple, oblong, emerginate at apex; outer tepals and inner tepals are the same length, outer tepals are wider, 2-2.5 × 1-1.2 mm; inner tepals 2-2.5 × 0.5-0.75 mm. Filaments simple, subulate, longer than the perigon, 3 - 3.5 mm,

base width 0.4-0.5 mm, connected below into an annulus 0.4-0.5 mm high; anthers oblong, cuneate at apex, 0.75-1.2 × 0.4-0.5 mm, purple. Ovary pyriform, 2-2.5 × 1-1.4 mm, base width 0.4-0.5 mm; style longer than tepals and stamens, 2.8 - 3 mm, pink near stigma; stigma is head-shaped. Capsule spherical, 4 × 3.5 mm, valves cordate, emerginate. Seed oblong, 2.8-3 × 1.5-2 mm, black.

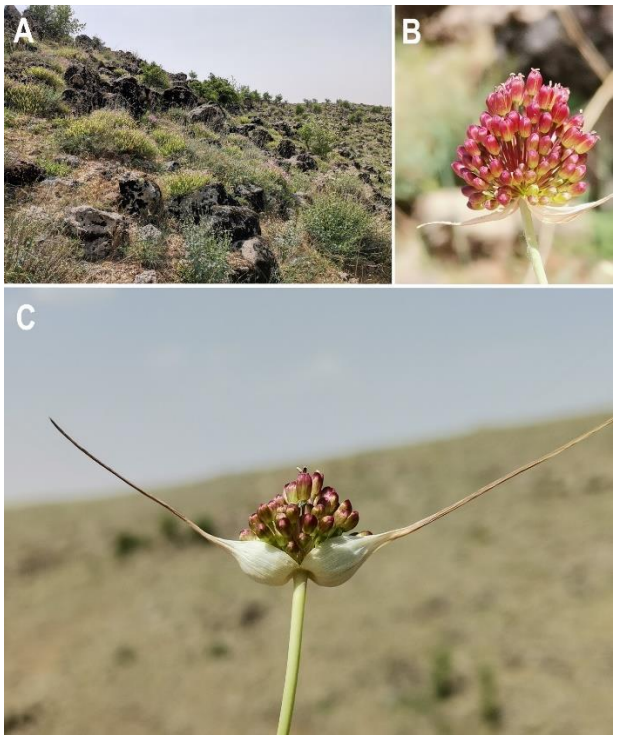

Figure 1. Natural habitat and general view of *Allium variegatum*

Comparison of the findings regarding the *Allium variegatum* with flora of Turkey is given in Table 2.

Contributions to *Allium ekeri* morphology

***Allium ekeri* E.Kaya & Koçyiğit, Türk. Geofitleri 3: 516 (2014).**

Type: Turkey. Şanlıurfa: around Germuş village 629 m, cult. fl. 26.5.2014, U. Rastgeldi 10073 (Holotype ISTE 102750).

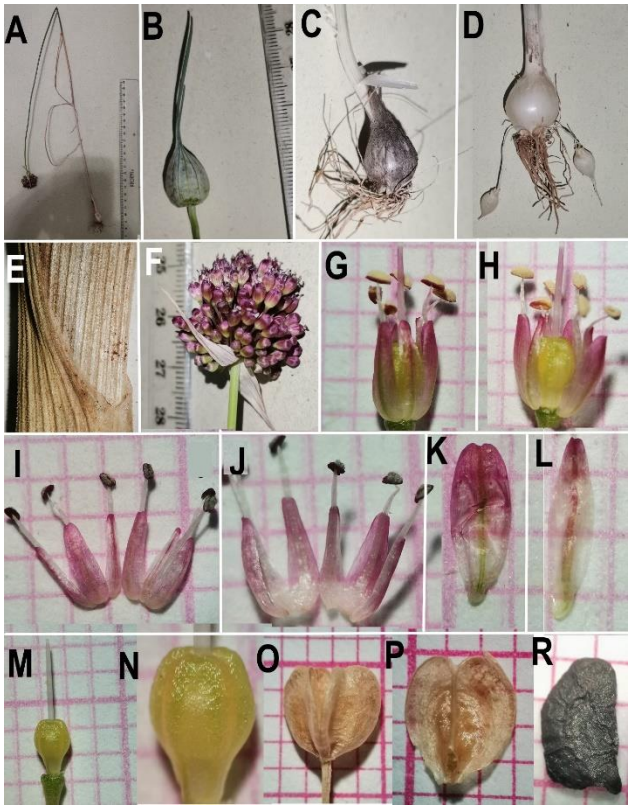

Figure 2. *Allium variegatum* A: General view, B: Before flowering (spata with 2 valves), C: Outer tunica, D: Inner tunica and bulbets, E: Stem sheath, F: Umbella, G: H: Perigon, I: Perigon opened (external view), J: Perigon opened (inside view), K: External perianth, L: Inner perianth, M-N: Ovarium, O: Capsule, P: Valve of Capsule, R: Seed.

Description: Bulbous perennial, bulb ovoid, 1-1.7 × 0.8-1.2 cm in diameter; **outer tunics** fibrous, black-brown, forming a 1.5-5.5 cm collar on stem; **inner tunics** white, membranous. **Stem** 20-45 cm, covered for up to 1/2 of its length by leaf sheaths. smooth. Leaves 2-4 number, cylindrical, fistulose, 2-3 mm wide, not exceeding inflorescence. Sheaths glabrous, ribbed, purplish close to the bulb. **Spathe** persistent, with 2 unequal valves, shorter than inflorescence, longer one 6-7-veined and 2.5-5 cm long, shorter one 5-6-veined, 1.7-3.8 cm long; ovate at the base, cylindrical at the apex. **Inflorescence** lax, nodding, almost spherical, 30-90 flowers, 3-4.5 cm in diameter; **pedicels** unequal 1.2-2.5 cm. **Perigon** cylindrical or globose, 5-5.5 mm long,

4-4.5 mm wide; **tepals** equal, oblong or globose, obtuse, truncate or emarginate at the apex, green, midrib dark green, 4.25-5 × 2.5-3 mm in diameter. **Filaments** simple, white, 4-4.5 mm long, slightly exserted, 0.7-1 mm wide at base, subulate at the apex, connected below into an annulus 1-1.5 mm high. **Anthers** yellow, 0.7-0.8 × 0.4-0.5 mm, oblong, obtuse at the apex. **Ovary** oblong, elliptical, stipitate, completely warty (scabrite), 2.75-3.5 × 2-2.25 mm. **Style** white, 2-3.5 mm long. **Capsule** triangular, subglobose or obovoid, 3.5-4 × 3.5-4 mm, **valves** obcordate, emarginate at apex, 4 × 4 mm. **Seeds** 3-3.5 × 1.5-2.5 mm, black.

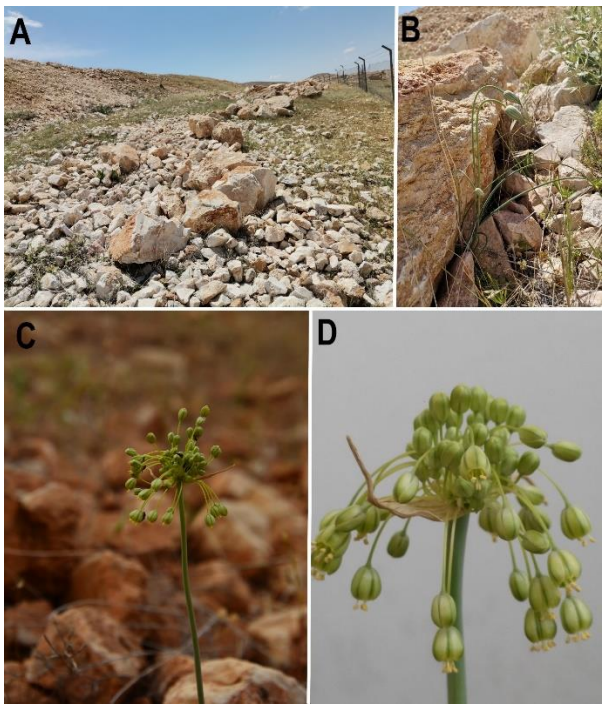

Figure 3. Natural habitat and general appearance of *Allium ekeri*

Comparison of the findings regarding the *Allium variegatum* with flora of Turkey is given in Table 3.

Conclusion

In this study, an updated list of the *Allium* genus distributed in Şanlıurfa was created. It was determined that 28 (8 of which are endemic) *Allium* taxa, were distributed in Şanlıurfa. *Allium deneliae, Allium halfetiense* var. *cecenii*, *Allium halfetiense* var. *halfetiense*, *Allium sultanae-ferhanii*, *Allium variegatum*, *Allium ekeri*, *Allium flavum* subsp. *tauricum* var. *pilosum*, Allium wendelboanum taxa are endemic.

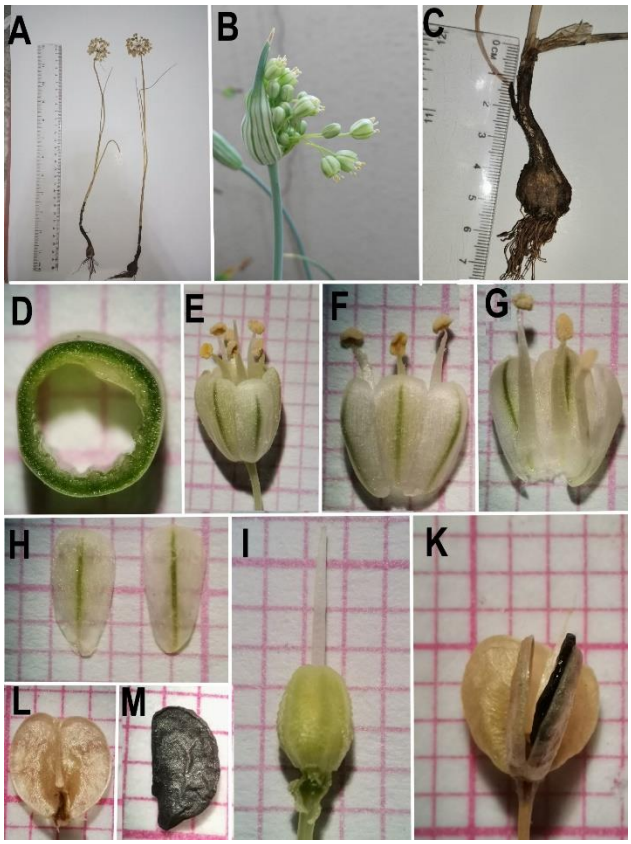

Figure 4. *Allium ekeri* A-General view, B-Umbella, C-Outer tunica of the bulb, D-Cross section of the leaf, E-Perigon, F-Perigon opened (external view), G-Perigon opened (inside view), H-Exterior and interior perianth, I-Ovary, K-Capsule, L-Capsule valve, M-Seed

Allium chloranthum, *Allium flavum* subsp. *tauricum* var. *pilosum, Allium pseudoflavum, Allium wendelboanum,* these taxa are new record taxa for Şanlıurfa flora.

The descriptions of *Allium variegatum* and *Allium ekeri* were expanded by making measurements on fresh samples with the help of a stereo-microscope.

In terms of phytogeographic regions, 19 are Irano-Turanian, 8 are Mediterranean and 1 is widely distributed. Endemic plants IUCN (2022) categories are VU (Vulnerable).

Suggestions

• Şanlıurfa is a province rich in *Allium*, • Species with ornamental plant value should be identified and evaluated, • Species on which biological and biochemical studies have not been conducted should be identified and their medical importance determined, • Endemic plants should be protected, • Detailed studies should be carried out for possible new species.

Information

This study was previously presented as an abstract at the IV International Agricultural, Biological and Life Science Conference (Balos 2022). The full text is given in this study.

Table 1. List of *Allium* taxa distributed in Şanlıurfa

Number	Taxon name	Turkish name	Phytogeographic region	IUCN category (2022)	Endemism
1	*Allium ampeloprasum*	pırasa	Medit.		
2	*Allium asclepiadeum*	koçsoğanı	Ir-Tur.		
3	*Allium callidyction*	kaya soğanı	Ir-Tur.		
4	*Allium calyptratum*	takkeli soğan	E. Medit.		
5	*Allium cardiostemon*	yamaçkörmeni	Ir-Tur.		
6	*Allium chloranthum*	salkımsoğan	E. Medit.		
7	*Allium chrysantherum*	sarıkafa	Ir-Tur.		
8	*Allium deneliae*	denelsoğanı	Ir-Tur.	VU	End.
9	*Allium dictyoprasum*	topsoğan	Ir-Tur.	-	-
10	*Allium ekeri*	eker soğanı	Ir-Tur.	VU	End.
11	*Allium tauricum* var. *pilosum*	toros sarısı	Ir-Tur.	VU	End.
12	*Allium flavum* subsp. *tauricum* var. *tauricum*	No data	Medit.		
13	*Allium halfetiense* var. *cecenii*	çeçensoğanı	Ir-Tur.	VU	End.
14	*Allium halfetiense* var. *halfetiense*	halfetisoğanı	Ir-Tur.	VU	End.
15	*Allium kharputense*	harput soğanı	Ir-Tur.		
16	*Allium nigrum*	karasoğan	Medit.		
17	*Allium noëanum*	ekinsoğanı	Ir-Tur.		
18	*Allium olivieri*	boynuzlusoğan	Ir-Tur.		
19	*Allium orientale*	doğusoğanı	Medit.		
20	*Allium pallens*	nursoğanı	Medit.		

21	*Allium pseudoflavum*	küllüsoğan	Ir-Tur.		
22	*Allium rotundum*	delipırasa	Widespread		
23	*Allium schergianum*	diclesirimi	Ir-Tur.		
24	*Allium stamineum*	yabansarmısağı	E. Medit.		
25	*Allium sultanae-ferhanii*	sultansoğanı	Ir-Tur.	VU	End.
26	*Allium trachycoleum*	bozsarmısak	Ir-Tur.		
27	*Allium variegatum*	dicle körmeni	Ir-Tur.	VU	End.
28	*Allium wendelboanum*	kuşsoğanı	Ir-Tur.	VU	End.

Table 2. Comparison of the findings regarding the *Allium variegatum* with flora of Turkey

Characters	This work (M. Balos 5214)	Flora of Turkey	Koçyiğit (2010), (AEF 18534/Diyarbakır)
Bulb	ovoid, 1-2.5 × 1.5-3 cm, with 1-3 white bulblets,	No data	ovoid, 1-1.5 × 1.5-2 cm; no bulblets
Tunic	outer tunics grey-black papery, forming collar on stem; inner tunics white, membranous	No data	outer tunics black, dark brown, papery, does not form a collar on stem; inner tunics white, membranous
Stem	50-70 cm	No data	30-70 cm
Leaves	3 number, 15-25 cm long, 1-1.5 mm in diameter	No data	3-4 number, 20-30 cm long, 1 mm diameter
Spathe	with 2 unequal valves, 5-6 nerved, longer one 2.5-3.5 cm, shorter one 2-2.5 cm.	No data	with 2 unequal valves, 4-5 nerved, longer one 2-4 cm, shorter one 1.5-2 cm
Umbella	spherical, 1.5-2.5 cm in diameter, with 50-100 flowers	No data	sphaerical, 1.5-3 cm in diameter, 100-300 flowers
Pedicels	pedicels unequal, 1-1.5 cm, glabrous, yellowish-green below, upper part purple	No data	almost equal, 1.5-2 cm, glabrous, pinkish
Tepals	greenish-purple, oblong, emerginate at apex; outer tepals and inner tepals are the same length; outer tepals are wider, 2-2.5 × 1-1.2 mm; inner tepals 2-2.5 × 0.5-0.75 mm	purple; perianth segments which are yellowish at the base oblong, emaiginate perianth segments and narrowly lanceolate	pinkish-purple, oblong, truncate; outer tepals shorter and wider, 2.3-2.2 × 1-1.5 mm; inner tepals 2.28-2.32 × 0.6 -0.8 mm
Filaments	3-3.5 mm, base width 0.4-0.5 mm, connected below into an annulus 0.4-0.5 mm high	No data	2.40-2.43 mm, base width 0.25-0.3 mm, connected below into an annulus 0.3-0.35 mm high
Anther	0.75-1.2 × 0.4-0.5 mm	No data	0.45-0.5 × 0.28-0.3 mm
Ovary	pyriform, 2-2.5 × 1-1.4 mm, base width 0.4-0.5 mm	No data	oblong-ovoid, 1.35-1.38 × 0.5-0.55 mm, base width 0.2-0.25 mm
Style	2.8-3 mm	No data	1.3-1.5 mm

Capsule	4 × 3.5 mm, valves cordate, emerginate	No data	3-3.3 × 2.8-3 mm, valves circular, emerginate at the apex
Seeds	oblong, 2.8-3 × 1.5-2 mm	No data	semicylindrical, 2.5-2.7 × 1.3-1.35 mm

Table 3. Comparison of the findings regarding the *Allium ekeri* with flora of Turkey

Characters	This work (M. Balos 5335)	Koçyiğit *et al*. 2014
Bulb	1-1.7 × 0.8-1.2 cm in diameter	1.5-2 × 0.8-1 cm diameter
Outer tunic	black-brown, fibrous, forming a 1.5-5.5 cm collar on stem	brown, fibrous
Inner tunic	white, membranous	white, membranous
Stem	20-45 cm, smooth	20-30 cm, glaucous
Leaves	2-4 number, cylindrical, fistulose, 2-3 mm wide	(1-) 2-3 (-4) number, (1-) 1.5-2 mm wide
Sheaths	glabrous, ribbed, purplish close to the bulb	No data
Spathe	persistent, with 2 unequal valves, shorter than inflorescence, longer one 6-7-veined and 2.5-5 cm long, shorter one 5-6-veined, 1.7-3.8 cm long	with 2 unequal valves, longer one 4-5-veined and 3.5-4 cm long, smaller one 3-4-veined, 2.5-3 cm long
Inflorescence	lax, nodding, almost spherical, 3-4.5 cm diameter, 30-90 flowers	dense, almost spherical, 3-4.5 cm diameter, 60-80 flowers
Pedicels	1.2-2.5 cm.	(1-) 1.5-2 (-2.5)
Perigone	cylindrical or globose, 5-5.5 mm long, 4-4.5 mm wide	almost globose
Tepals	oblong or globose, obtuse, truncate or emarginate at the apex, green, midrib dark green, 4-5 × 2-3 mm in diameter	oblong, truncate or emerginated at apex, green, with dark green midrib, 4-4.5 × 4.5-5 mm
Filaments	4-4.5 mm long, 0.7-1 mm wide at base, connected below into an annulus 1-1.5 mm high	0.4-0.5 mm wide at base, connate at the base into an annulus 0.5 mm high.
Anther	1-1.5 × 0.8-1 mm, oblong, rounded at the apex	0.7-0.8 x 0.4-0.5 mm, oblong, obtuse at apex
Ovary	oblong, elliptical, stipitate, completely warty (scabrite), 2.75-3.5 × 2-2.25 mm	shortly oblong, 2.5-2.8 × 2-2.2 mm
Style	2-3.5 mm long	1-1.5 mm long
Capsule	subglobose or obovoid, 3.5-4 × 3.5-4.5 mm,	4.5-5 × 4.5-5 mm
Capsule valves	valves obcordate, emarginate at apex, 4 × 4 mm	almost orbiculate
Seeds	3-3.5 × 1.5-2.5 mm	3-4 × 2 mm

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