



Taxonomical remarks on *Allium yamadagensis* Yıldırım & Ekşi, (Amaryllidaceae) from Turkey

Emrah ŞİRİN^{*1}, Mehmet Cengiz KARAİSMAİLOĞLU²
ORCID: : 0000-0003-3408-7186; 0000-0002-6856-2742

¹ Department of Biology, Faculty of Science, Selçuk University, 42125, Konya, Turkey

² Department of Biology, Faculty of Arts and Sciences, Siirt University, 56500, Siirt, Turkey

Abstract

An evaluation was conducted of *A. yamadagensis*, which is a Critically Endangered (CR) species that is endemic to Turkey, comprising an analysis of its taxonomical, micromorphological, macromorphological, cytological and palynological features, in addition to its geographical distribution. Scanning Electron Microscopy was used to obtain seed and pollen surface microphotographs. The shape and sculpturing of the seed periclinal walls are convex and granulose. The shape of the pollen grains appears monocolpate, with polar and equatorial axes of 23.65 ± 0.29 and 14.92 ± 0.33 μm , respectively. *A. yamadagensis* has a pollen ornamentation that is foveolate-microreticulate. Cytological analyses revealed that *A. yamadagensis* is diploid and has a chromosome number of $2n = 2x = 16$.

Keywords: chromosome, cytology, morphology, palynology

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Türkiye'den *Allium yamadagensis* Yıldırım ve Ekşi (Amaryllidaceae) üzerine taksonomik açıklamalar

Özet

Bu çalışma, Türkiye'den Kritik Tehlike Altındaki (CR) bir endemik tür olan *A. yamadagensis*'in coğrafi dağılımı ile birlikte taksonomik, makro ve mikro morfolojik, palinolojik ve sitolojik özelliklerin değerlendirilmesini rapor etmektedir. Tohumların ve polenin yüzey mikro fotoğrafları Taramalı Elektron Mikroskobu kullanılarak elde edildi. Tohum periklinal duvarları (şekil ve yontma) dışbükey ve granül. Polen taneleri, 23.65 ± 0.29 μm kutup eksenleri ve 14.92 ± 0.33 μm ekvator eksenleri ile tek kolpat şeklinde görünür. *A. yamadagensis*'in polen süslemesi foveolat-mikroretikülatır. Sitolojik araştırmalar, *A. yamadagensis*'in $2n = 2x = 16$ kromozomlu diploid olduğunu ortaya çıkarmıştır.

Anahtar kelimeler: kromozom, morfoloji, palinoloji, sitoloji

1. Introduction

Within the family Amaryllidaceae, *Allium* L. is among the largest genera [1]. More species have been described since Linnaeus accepted the first 30 species, and now comprises over 920 [2]. In Turkey, there are now about 220 *Allium* taxa [3], which have been divided into 14 sections [4], comprising a significant portion of the southeastern Asian center of diversity for *Allium* [5].

A. yamadagensis is closely related to *A. sintenisii* Freyn, *A. erzincanicum* Özhatay & Kandemir, *A. ekimianum* Ekşi, Koyuncu & Özkan, and *A. asperiflorum* Miscz. and all of them belong to section *Allium* [6].

Seed morphology provides useful systematic characters at various taxonomic levels in the genus *Allium* [7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17].

Chromosomes give important information about plant systematic. Particularly, the chromosome numbers in each cell, size of the chromosomes and centromere position are being studied [18].

* Corresponding author / Haberleşmeden sorumlu yazar: Tel.: +903322231881; Fax.: +903322231881; E-mail: emrahsirin@selcuk.edu.tr

In this work, morphological (macro and micro), palynological, and cytological features of *Allium yamadagensis* in Turkey have been studied for the first time.

2. Materials and methods

Specimens were collected by the first author and were kept in the herbarium of the Science Faculty of Selçuk University (KNYA). At least ten seed and pollen for each species were dehydrated in alcohol series (70%, 80%, 96% and 100%) in SEM analyses for cleaning process. Seed and pollen were coated with gold under ZEISS EVO LS-10 model SEM high-vacuum mode for observing their surface. For the seed length and width 20–25 seeds were measured. Seed shape was recognized following overall plane or two-dimensional shape as standardized by [19]. The names of the different types of undulation followed the terminology as defined and adopted by [20]. In addition, the stereo microscope images of the seeds were photographed with the LEICA DFC295 digital camera attached to the LEICA S8AP0 microscope.

Karyological observations were made on mitotic metaphase cells of root-tips obtained from planted bulbs which were collected in natural habitats from Turkey. Root tips were pretreated in α -monobromonaphthalene at 4°C overnight, washed with distilled water and fixed in Carnoy's solution (3:1 absolute ethanol: glacial acetic acid) for a minimum of 1 h. The root tips were hydrolyzed for 10–12 minutes in 1N HCl at 60°C, stained using the standard Feulgen technique and squashes were prepared. Permanent slides were made by the liquid CO₂ method (For chromosomal analyses the protocol of [21] was applied).

Collection address of the studied samples: Malatya, Hekimhan, summit of Yamadağ, stony places, 2545 m, 27 July 2018, *E. Şirin* 740 (KNYA), in fruit.

3. Results

Allium yamadagensis Yıldırım & Ekşi (2019: 31).

Type: TURKEY. Malatya: Hekimhan, Yama Mountain, summit, volcanic rocky slopes, 2570 m, 27 July 2015, *H. Yıldırım* 3487 (holotype, EGE, isotypes, EGE, NGBB, ANK, HUB) (Figure 1).

Additionally, morphological characters are as follows: Scape cylindrical, style linear and creamy white, pedicel cylindrical, filament fleshy, anther elliptic and apiculate at apex, bulblets brownish black, ovary yellowish green, inflorescence fastigate at flowering time.

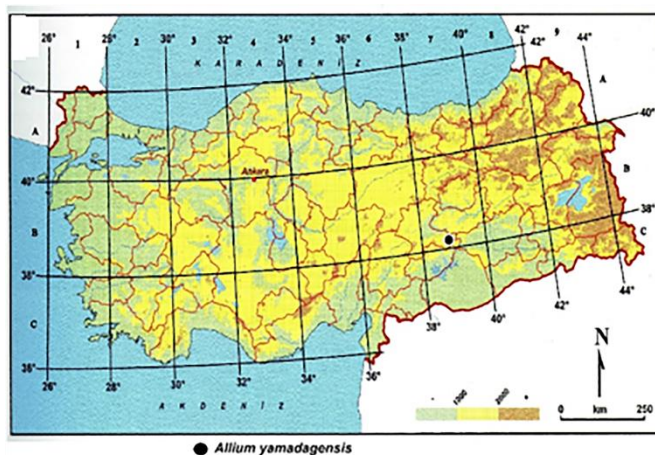


Figure 1. Distribution map of *A. yamadagensis*

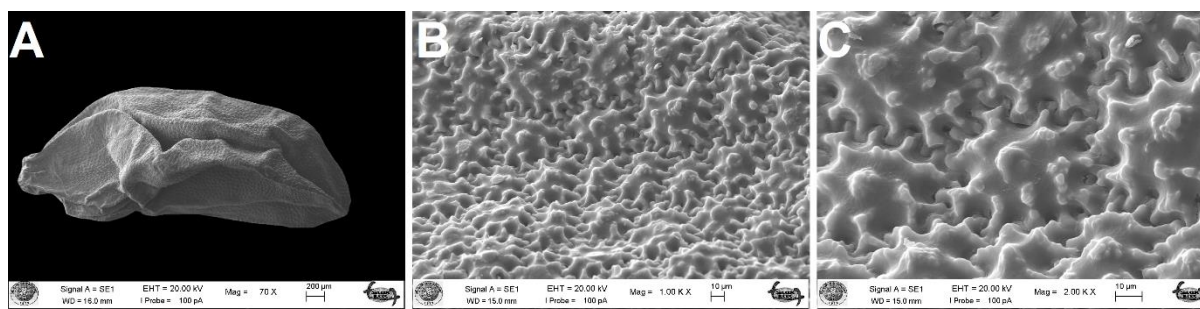


Figure 2. SEM images of *A. yamadagensis* seeds. A: General view, B: 1000× magnification, C: 2000× magnification

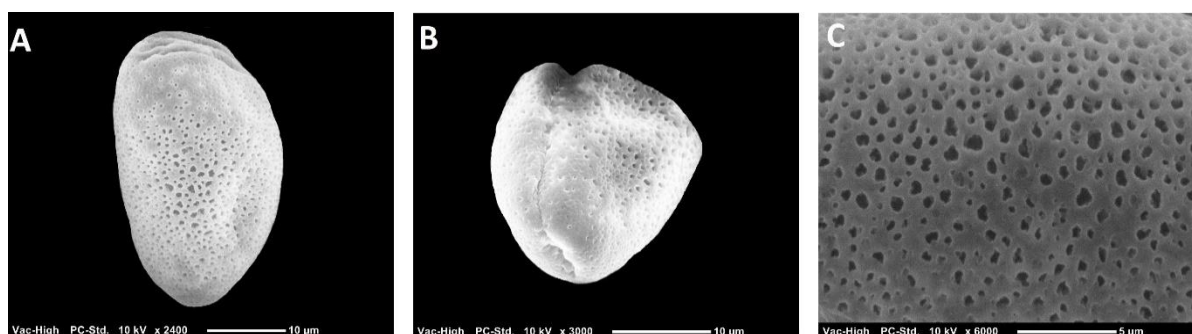


Figure 3. SEM images of *A. yamadagensis* pollen grains. A: General view, B: 3000× magnification, C: 6000× magnification

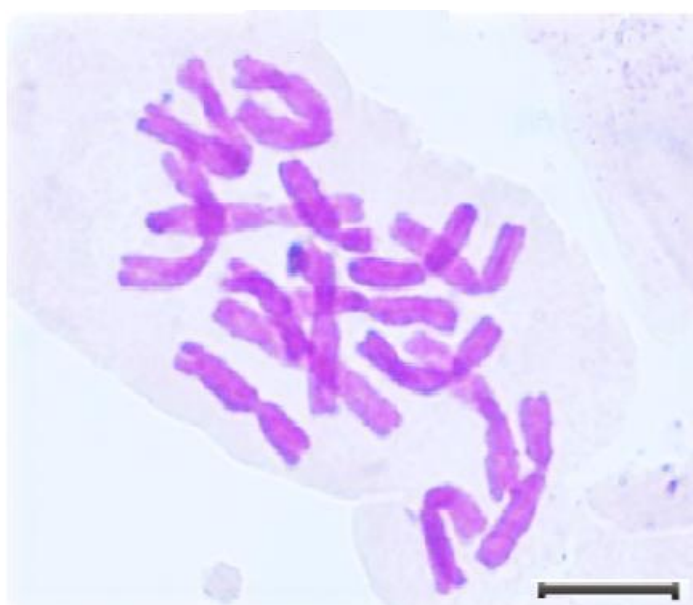


Figure 4. *A. yamadagensis* chromosomes in metaphase plate ($2n=16$, scale bar=10 µm)

Seed morphology of *A. yamadagensis* as follows: Seed length 3.5–3.8 mm, seed width 1.5–1.6 mm, L/W Ratio 2.35, seed shape ovate, dominant shape of testa cells ovate–elliptic, periclinal walls (shape and sculpturing) convex, granulate, many irregularly shaped and sized verrucae, anticlinal walls (position, shape, undulation type) fissured, Omega–like undulated (Figure 2).

The pollen characteristics of taxon are identified. The pollen has offered in Figure 3. They were anisopolar and prolate in figures, with polar axes of 23.65 ± 0.29 µm and equatorial axes of 14.92 ± 0.33 µm, with oval outlines in the equatorial axes (Figure 3). They are of monocolpate apertures. Also, the colpus size varies between 22.17 and 26.05 µm in length, and between 2.41 and 4.75 µm in width. The margins are organized, and the ends are rounded (Figure 3). The pollen ornamentation of taxon is foveolate-microreticulate. The lumina consists of polygonal and alveolar cells. The chromosome number of *A. yamadagensis*, $2n = 16$, counted in root tips, is also reported and illustrated (Figure 4).

Table 1. New characters for the examined taxon and their comparison with the descriptions in the protologue

Characters	The obtained outcomes from this investigation
Scape shape	cylindrical
Style shape and colour	Linear, creamy white
Pedicel shape	cylindrical
Filament	fleshy
Anther shape	elliptic, apiculate at apex
Bulblets colour	brownish black
Ovary colour	yellowish green
Inflorescence	fastigiata at flowering time

4. Conclusions and discussion

A. yamadagensis is morphologically similar to *A. sintenisii* and differs from it by smaller perigones, scabrid pedicels, loosely bearded and scabrid inner tepals, exerted stamens and scabrid ovary surfaces [6]. The results obtained from morphological studies were consistent with description given in the protologue [6]. Our results allowed to expand the morphological description of some parts (scape, bulblet, style, pedicel, filament, anther and ovary) or to give data for the first time (palynology, micromorphology and karyology) (Table 1). [22] referred from chromosome numbers belonging to seven taxa in the section *Allium* (subg. *Allium*). All of them have $x=8$ base chromosome numbers similar to *A. yamadagensis*. *A. heldreichii* Boiss., *A. scorodoprasum* subsp. *rotundum* (L.) Stearn, *A. sativum* L and *A. sphaerocephalon* L. are at the same ploidy level (diploid) with *A. yamadagensis*. Conversely, *A. ampeloprasum* L., *A. margaritaceum* Sibth, and *A. porrum* L. are tetraploid. Otherwise, [21] studied 19 species belonging to *Allium* L. sect. *Melanocrommyum* Webb et Berthel from Turkey. Similarly, they established same chromosome number ($2n = 16$) in 18 species, only *A. cyrilli* Ten. was tetraploid with $2n = 32$.

Seed morphology studies belonging to subgen. *Allium* sect. *Allium* as follows: [5] two species (*A. aybukeae* H. Duman & Eksi and *A. bilgili* H.Duman & Eksi) and [23] one species (*A. porrum* L.). Seed measurements and morphology of *A. yamadagensis* mostly support these studies.

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