Allium cyrilli complex (sect. Melanocrommyum) in Turkey

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1. Introduction
The genus Allium L. is a very variable and taxonomically difficult genus naturally distributed over the northern hemisphere. The most recent classification proposal for this genus based on morphological characters and considering also molecular data accepted about 780 species belonging to 15 subgenera (Friesen et al., 2006). Recent additions raised the species number to more than 850 (Keusgen et al., 2011). The taxonomic classification of the genus Allium is still in progress.

The subg. Melanocrommyum (Webb & Berthel.) Rouy is the second largest subgenus, comprising about 160 accepted species (Fritsch et al., 2010) grouped into 20 sections. These species, specifically adapted to arid conditions, occur from the Mediterranean to the Near and Middle East, reaching north-western China and Pakistan in the east and southern Siberia in the north. According to this recent classification, sect. Melanocrommyum consists of 41 species.

In Flora Europaea (Stearn, 1980), the following species of the sect. Melanocrommyum were cited: Allium nigrum L., A. cyrilli Ten., A. atropurpureum Waldst. & Kit., and A. decipiens Fisch. ex Schultes & Schult. f., to clarify their occurrence in Turkey and their taxonomy. The results of this study show that A. atropurpureum and A. decipiens do not occur in Turkey. On the other hand, A. cyrilli is represented by 3 subspecies of which 2 are new for science: subsp. fritschii N.Özhatay & İ.Genç and subsp. asumaniae N.Özhatay & İ.Genç. The diagnostic morphological characters, distribution, conservation status, and colour photographs of the 3 subspecies as well as their chromosome numbers are presented: 2n = 16 (diploid) for subsp. fritschii, and 2n = 32 (tetraploid) for subsp. asumaniae and subsp. cyrilli.

Key words: Allium, Melanocrommyum, chromosome number, new subspecies, Turkey

2. Materials and methods
During this revision of the sect. Melanocrommyum in Turkey, numerous field trips were conducted and specimens were collected all around Turkey. Herbarium specimens were deposited in ISTE, and living bulbs were planted for chromosome counting in the research garden. For taxonomical studies many herbarium specimens were examined from various herbaria (AEF, ANK, BM, E, GAZI, HUB, ISTE, ISTF, ISTO, K, V ANF). These specimens are cited in the Appendix as "additionally examined specimens".

For chromosome counts, root tips were collected from planted bulbs collected from natural habitats, pretreated...
with ABN (α-monobromonaphthalene) at 4 °C overnight, and fixed in Carnoy's solution. They were stained using the standard Feulgen technique and squash preparations were prepared. Slides were made permanent by the liquid CO₂ method. Photographs were taken with an Olympus BH2 photomicroscope.

3. Results and discussion
In the Flora of Turkey these 3 closely related species were cited as good species and distinct species. After the revision of Turkish specimens their occurrence in Turkey is clarified, and also the taxonomic state of the cited specimens has been determined. As result, a comparison between the diagnostic characters of these species is given in the following Table.

3.1. Allium atropurpureum Waldst. & Kit.
In Turkey A. cyrilli is very variable in terms of the perianth segment colour, which may change from greenish white to pinkish (Figure 1), but it is never changing to blackish purple, whereas perianth segments and ovary colours of A. atropurpureum are blackish purple and this is the most important diagnostic characteristic for the species. In many herbaria the pinkish A. cyrilli specimens were determined as A. atropurpureum; we regard this as a misidentification. On the living materials of A. cyrilli, the midvein is green and obviously thick, covering at least 1/3 of the inner surface of perianth segments. The pinkish specimens possess this green and thick midvein, which is characteristic for A. cyrilli. In A. atropurpureum the midvein is in the form of a generally blackish purple line never covering 1/3 of the inner surface.

3.2. Allium decipiens Fisch. ex Schultes & Schultes f.
A. decipiens Fisch. ex Schultes & Schultes f. subsp. quercetorum Seregin was described from the Crimean and NW Caucasus mountains by Seregin (2007). In that article a comprehensive description was given for A. decipiens. According to the results of that article A. decipiens should be excluded from the Turkish flora. The results of our study support Seregin's results. The specimens named A. decipiens in the Turkish flora belong to a new subspecies, A. cyrilli subsp. fritschii.

3.3. Allium cyrilli Ten.
This East Mediterranean species is distributed S Italy, S and E Greece, western Turkey, and the Crimea. In Turkey, it is very variable concerning umbel shape and perianth segment colour. The specimens cited as A. decipiens in the Flora of Turkey (Kollmann, 1984) differ from A. cyrilli by perianth segment diameter, filament shape, and chromosome numbers. After field and herbarium studies these specimens were identified as a new subspecies and named A. cyrilli subsp. fritschii. Another specimen collected near Lake Abant is closely related to A. cyrilli. It differs from the other subspecies by habitat, scape length, and base of filaments united for nearly 1–1.5 mm. It is named A. cyrilli subsp. asumaniae. According to this research A. cyrilli is represented in Turkey by 3 subspecies. Full and detailed descriptions of A. cyrilli and the new subspecies are given below.

3.4. Re-description of Allium cyrilli
Bulb ovoid, 1–3.5 cm diameter; outer tunics membranous, greyish or greyish white. Scape (20–)30–80(–100) cm long, cylindrical. Leaves 2–6, broadly linear, 10–36 mm

### Table. Diagnostic characters of Allium cyrilli, A. atropurpureum, and A. decipiens.

<table>
<thead>
<tr>
<th>Characters</th>
<th>A. cyrilli</th>
<th>A. atropurpureum</th>
<th>A. decipiens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulb</td>
<td>ovoid</td>
<td>subglobose</td>
<td>globose</td>
</tr>
<tr>
<td>Tunic</td>
<td>membranous</td>
<td>membranous</td>
<td>coriaceo-papyraceous</td>
</tr>
<tr>
<td>Scape</td>
<td>(20–)30–80(–100)</td>
<td>40–100</td>
<td>40–100</td>
</tr>
<tr>
<td>Leaves</td>
<td>(2–)3–6, broadly linear</td>
<td>3–7, broadly linear</td>
<td>2–4, linear to linear-lanceolate</td>
</tr>
<tr>
<td>Inflorescence</td>
<td>fastigiate</td>
<td>fastigiate</td>
<td>hemispherical</td>
</tr>
<tr>
<td>Perianth segments</td>
<td>after anthesis curving inwards</td>
<td>after anthesis reflexed</td>
<td>after anthesis reflexed and twisted outwards (3.5–)4–5 (–5.5) × 1(–1.5) mm, usually whitish (greenish) (occasionally rose when dry), with darker (green or purple) midvein, shortly acute</td>
</tr>
<tr>
<td>Filaments</td>
<td>fleshy, 5–6 mm, white or pinkish, fleshy, 4–5 mm, purplish, gradually narrowed above</td>
<td>abruptly narrowed above</td>
<td>non-fleshy, up to 3.5(–)4 mm long, whitish and subulate above</td>
</tr>
<tr>
<td>Ovary</td>
<td>green or purple</td>
<td>dark purple or blackish</td>
<td>green</td>
</tr>
<tr>
<td>Capsule</td>
<td>pear shaped</td>
<td>globose</td>
<td>globose</td>
</tr>
<tr>
<td>Chromosomes (2n)</td>
<td>32, 16</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

40
wide, as long as ½ of scape or sometimes longer than ½ of scape (subsp. *asumaniae*, subsp. *fritschii*), glaucous. Spathe split in 2–3 triangular parts. Inflorescence fastigiate, generally dense, 3–7 cm in diameter. Pedicels 2–5 × perianth segments, almost equal, greenish or slightly carmine flushed. Perianth segments curving inwards at anthesis, linear, slightly boat-shaped, with an acute tip, 5.5–10 mm long and 1–1.5(–2) mm wide, white purplish pink with wide, dark green median vein. Filaments 3/4 as long as tepals, fleshy, basally united, triangular at base, gradually or sometimes abruptly (subsp. *fritschii*) narrowed above, white pinkish (Figure 2). Anthers yellow or purple. Ovary green-purple. Capsule pyriform, 4.5–7 mm wide.

Flowering in May and June, fruiting in June and July. 2n = 16, 32

Distribution in Turkey: European Turkey and North and West Anatolia (Figure 3).

Diagnostic key for subspecies:
1. Filaments triangular at base, abruptly narrowed above, base of inner filaments nearly twice as broad as base of outer ones ............................................ subsp. *fritschii*

Figure 1. *Allium cyrilli* subsp. *cyrilli*: a–d = inflorescence variations; subsp. *asumaniae*: e = habit (from Abant, type locality), f = Inflorescence; subsp. *fritschii*: g = Inflorescence, h = habit (Photo: İ. Genç).

Figure 2. Perianth segments & filaments of *Allium cyrilli*: a = subsp. *cyrilli*, b = subsp. *asumaniae*, c = subsp. *fritschii*. 
1. Filaments narrowly triangular at base, gradually narrowed above, all filaments nearly equally broad

2. Scape 40–100 cm, filaments united at base for less than 1 mm, habitat generally cultivated fields and field borders ............................................................... subsp. cyrilli

2. Scape shorter than 40 cm, filaments united at base for nearly 1–1.5 mm, habitat open meadows .......................... subsp. asumaniae

**Description of the subspecies:**


Described from material cultivated at the Royal Botanic Garden, Naples, Originating from Puglia (Italy).

Type: Italy, in campis Lucaniae Apuliae (Puglia), 1857, Tenore s.n. (holotype: FI, barcode FI002694!, isotype: M)

*A. elmaliense* I.G.Deniz et Sümbül (Deniz & Sümbül, 2004) is regarded as synonym of *A. cyrilli* by Parolly and Eren (2006). However, our results show that *A. elmaliense* is a good species. This complication will be discussed in a separate paper.

**Habitat:** In Turkey, *A. cyrilli* subsp. *cyrilli* grows in cultivated fields and field borders at an altitude of s.l. - 1450 m.

**Distribution:** S Italy, S & E Greece, Serbia, W & NW Turkey, Crimea.

**Conservation status:** According to IUCN criteria (2001), *A. cyrilli* subsp. *cyrilli* is evaluated as Endangered (EN): the taxon lives naturally in cultivated fields and field borders in Turkey. Therefore, the populations are under threat from herbicides and deep ploughing. An estimated population size reduction of ≥70% over the last 10 years occurred based on area of occupancy, extent of occurrence, and quality of habitat (A1c).

Moreover, the population size was estimated to number fewer than 2500 mature individuals connected with a continuing decline inferred in numbers of mature individuals, and no subpopulation was estimated to contain more than 250 mature individuals [C2a(i)].

*A. cyrilli* Ten. subsp. *asumaniae* N.Özhatay & I.Genç subsp. nov.

Type: Turkey. A3 Bolu: The hillsides near Lake Abant, 1360 m, 04.vi.1977, A.Baytop s.n. (Holotype: ISTE 37401)

Scape 20–40 cm long. Leaves 2–3, linear, 1–1.5 cm wide, generally as long as scape. Pedicels 2–3 × perianth segments. Perianth segments linear-elliptic, with an acute tip, 6–7 mm long and 1–1.5 mm wide, purplish pink. Filaments 5–5.5 mm, triangular at base, gradually narrowed above (Figure 2), filaments connate at base for ca. 1–1.5 mm, generally pinkish. Anthers dark purple. Capsule globose. 2n = 32.

**Etymology:** This new subspecies is named in honour of Prof. Dr. Asuman Baytop, a well-known Turkish botanist who has made incredible contributions to knowledge of the Turkish flora.

**Habitat:** *A. cyrilli* subsp. *asumaniae* grows in open forests and meadows at an altitude of 1350–1360 m.

**Distribution:** Endemic, *A. cyrilli* subsp. *asumaniae* is known from the type locality only.

**Conservation status:** According to IUCN criteria (2001), *A. cyrilli* subsp. *asumaniae* is evaluated as Critically Endangered (CR): area of occupancy is estimated to be less than 10 km² and it is known to exist at only a single location (B2a).

*Allium cyrilli* Ten. subsp. *fritschii* N.Özhatay & I.Genç subsp. nov.

Type: Turkey. A4 Kastamonu: Daday–Azdavay highway, 6 km to Azdavay, 850 m, 07.vi.1984, N. & E. Özhatay s.n. (Holotype: ISTE 54173)

Scape 30–70 cm long. Leaves 2–6, broadly linear, 1.5–3.6 cm wide. Pedicels 2–3 × perianth segments. Perianth segments linear-lanceolate, with a subacute tip, 5.5–6.5 mm long and 1.5(–2) mm wide, rose pink. Filaments 4.5–5
mm, triangular at base, abruptly narrowed above, base of inner filaments nearly twice as broad as base of outer ones (Figure 2), generally white. Anthers dark purple. Capsule globose. 2n = 16

**Etymology:** This new subspecies is named in honour of Prof. Dr. Reinhard M. Fritsch from Gatersleben (Germany), who is a specialist on the taxonomy of the genus *Allium*, especially subg. *Melanocrommyum*.

**Habitat:** *A. cyrilli* subsp. *fritschii* grows in cultivated fields at an altitude of 750–1300 m.

**Distribution:** *A. cyrilli* subsp. *fritschii* is distributed around Kastamonu Province in NW Turkey.

**Conservation status:** According to IUCN criteria (2001), *A. cyrilli* subsp. *fritschii* is evaluated as Vulnerable (VU): a direct observation resulted in a decline in quality of habitat and population size reduction of ≥50% over the last 10 years (A1ac). Extent of occurrence estimated to be less than 20,000 km² and known to exist at no more than 10 locations (B1a).

**Karyology**

All the investigated populations of *Allium cyrilli* subsp. *cyrilli* showed a tetraploid chromosome complement with 2n = 32 (Figure 4). The species was regarded as tetraploid in previous studies (Vakhtina & Kudryashova, 1982; Özhatay, 1990; Ohri et al., 1998). *A. cyrilli* subsp. *asumaniae* is a tetraploid taxon with a somatic chromosome number of 2n = 32 (Figure 4) and *A. cyrilli* subsp. *fritschii* is a diploid taxon with a somatic chromosome number of 2n = 16 (Figure 4).

**Acknowledgements**

This work was supported by the Research Fund of Istanbul University, Istanbul, Turkey (project number 798). We would like to thank the curators of the following herbaria: AEF, ANK, BM, E, FI, GAZI, HUB, ISTE, ISTO, K, and VAN, for their permission to examine the herbarium specimens. The authors are grateful to Mehmet Koyuncu for sharing his knowledge and specimens, and also to RM Fritsch for criticism about the identification.

**Appendix**

**Additionally examined specimens**

References


